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Advertising Index, Last Page

Four Men—One Shift Do More Work Than Six Men—Three Shifts

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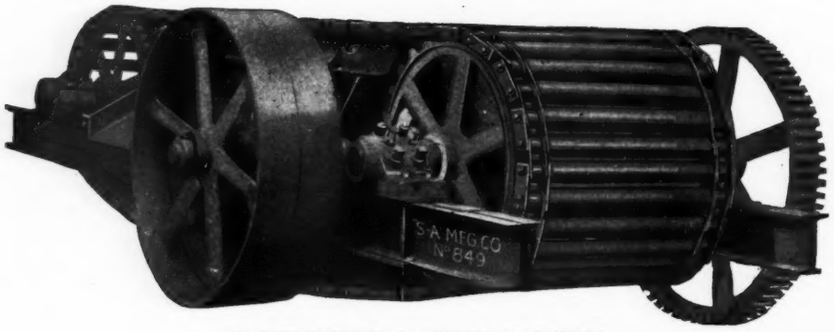

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Engineering and Mining Journal

VOLUME 103 JUNE 2, 1917 NUMBER 22

Quarrying Limestone Underground

By Raymond B. Ladoo*

SYNOPSIS—Underground quarries are found to be more economically operated than open work, owing to the thickness of overburden. By systematically working in benches and loading with compressed-air operated shovel, costs have been reduced in spite of advance in cost of supplies, by increased efficiencies.

Limestone is extracted from an underground quarry at Low Moor, a station on the Chesapeake & Ohio R.R. in Alleghany County, Virginia. Low Moor is in the heart of the iron district of the western part of Virginia, and its limestone is used as a flux in the blast furnaces of the Low Moor Iron Co. of Virginia, two of which are situated at Low Moor and one at Covington, eight miles west of Low Moor. The quarry proper is in a typical Alleghany mountain valley at an altitude of about 1200 ft. above mean sea level and about a half-mile from the C. & O. station. A company standard-gage railroad to Rich Patch mines passes by the quarry and is used to transport the stone to the furnace, which is near the station.

Limestone was first quarried here in 1880 or before, but was worked in the early days entirely as an opencut. After several years the overbuden became too heavy to make stripping profitable and it was decided to start underground. At first the underground work was carried on practically upon a level with the track and the stone was mined in huge chambers. Illustrations show the entrance and just inside the entrance to the old quarry.

As the gentle dip of the formations carried the foot wall deeper, it was found necessary to sink shafts to reach it, and at present an inclined shaft of about 50 ft. vertical depth (123 ft. on an inclination of 30°) is the prinicpal outlet to the surface.

The limestone bed varies in thickness from 40 to 65 ft., dipping about northeast at an angle of from about 15° in the old to nearly flat in the present workings.

ENTRANCE TO OLD UNDERGROUND LIMESTONE QUARRY, LOW MOOR, VA.

*Mining engineer, Low Moor Iron Co., Low Moor, Va.

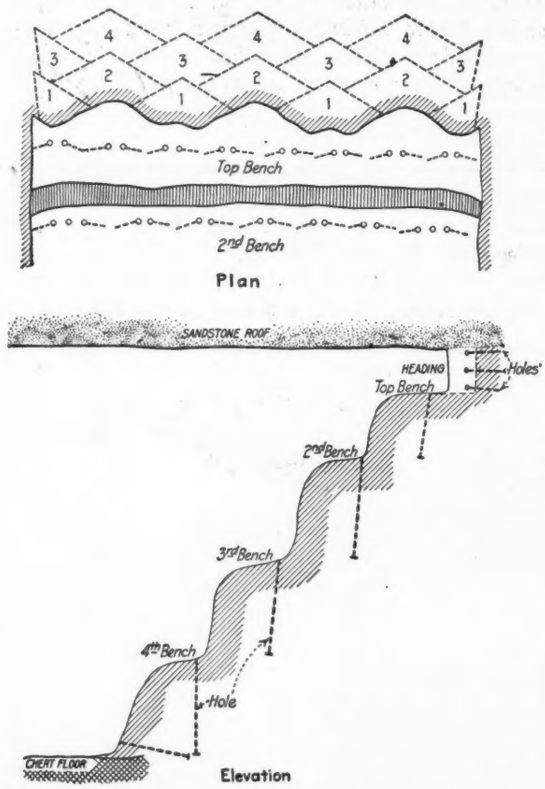
The stone is overlain by 15 to 18 ft. of sandstone and has as a foot wall a very siliceous, cherty limestone, known locally as "flint." Between the top of the usable stone and the sandstone there is usually found about 2 ft. of stone too high in insoluble to be used as a flux.

The geology of this deposit is not complicated. The limestone occurs in the Oriskany formation, overlain by a great thickness of Romney shale of the Devonian and underlain by the Helderberg limestone of the Silurian. C. M. Weld ("Economic Geology," Vol. X, No. 5, July-August, 1915) assigns to the Oriskany the following: (1) Calcareous sandstone, 0.50 ft., iron-bearing horizon between (1) and (2); (2) limestone, massive and frequently abundantly fossiliferous, including a persistent cherty horizon, 10-100 ft.; (3) massive sandstone with occasional shale 15-200 ft. All authorities do not agree with Weld, but place both (2) and (3) with the underlying Helderberg (U. S. G. S. Lewiston) limestone. The author, however, favors Weld's views, as they seem more consistent with the field evidence.

The stone itself is medium-grained, often fossiliferous, and varies in color from a bluish gray to nearly white. In places a nearly vertical jointing is prominent, and often these potential cracks become real cracks or seams filled with clay or mud. Circulation of underground water has been prominent along these seams in part of the quarry, and the seams have become caves. These vary in size from mere fissures to large, high chambers, sometimes filled with clay, but more often with long, open galleries with fantastic water-worn shapes in the channelways and filled with stalactites and stalagmites in more sheltered spots. These caves have an important bearing upon the method of quarrying used. The stone has an average analysis of about 3.4% insoluble and 1.2% alumina, and the clay that is found in the seams carries a small percentage of zinc that may be of commercial value at some time in the future.

The general method of quarrying can be understood from an examination of the illustrations. The overlying sandstone affords an excellent roof except in places where a cave is encountered. It is thus possible to open up galleries and chambers to the full height of the bed and 50 to 60 ft. wide without any support whatever for the roof. This, coupled with the fact that the quarry is always dry, makes working conditions practically perfect. From the foot of the incline, galleries 50 to 60 ft. wide and the full height of the stone are turned off in each direction. At intervals of about 50 ft. rooms 50 to 60 ft. wide are turned at right angles and broken through to the next gallery. This is the ideal system aimed at, but in practice it is usually modified owing to the presence of the caves before mentioned. In the part of the quarry now being worked the caves are usually five to six ft. high and about the same width and lie immediately beneath the sandstone roof. Unfortunately, the roof is usually insecure over the caves and it is thus dangerous to continue a room beyond such a cave. For this reason many rooms are never holed through and the pillars stand as long ribs between galleries. The quarry, as it stands now, has departed from the original room-and-pillar system. Various methods for crossing beneath caves have been devised, but none of them has been found acceptable practically or advisable financially. When it is absolutely necessary to cross beneath a small cave, a method of timbering at the top has been fairly successful.

The gallery itself has been carried along as a typical breast slope. A heading 6 ft. high and the full width of the gallery is started at the top of the limestone either immediately beneath the sandstone roof or beneath the thin layer of poor stone under the sandstone. As a rule this poor stone does not make as strong a roof as the sandstone, and it is sometimes necessary to remove it as waste. After the heading has been advanced 7 to 8 ft., the top bench is worked off about 10 ft. high while the heading is being advanced again. This continues until a series of 10-ft. benches from the heading to the floor has been completed. Then the whole breast is carried along together with the heading always 7 to 8 ft. ahead of the first bench. The placement of holes and the method of advancing the breast have been well described by C. M. Weld and F. U. Humbert (*Harvard Enginering Journal*, Vol. XII, No. 1, April, 1913), but has been slightly modified recently. The heading is advanced by drilling and shooting a series of diamond-shaped "locks," as shown in the above illustration. For each "lock" six 8-ft. holes are drilled in two vertical rows of three each, two uppers, two breast and two dip holes, each pair converging. Where the end locks intersect the pillars, rib holes are put in about 6 ft. deep. When this round of holes has been fired, "locks" 1 will have been removed and the holes for "locks" 2 are started. Each set of locks advances the heading about 2.5 ft., and thus three sets of locks must be drilled and shot for each bench shot. This placement of holes is very advantageous since it always preserves exceptionally good breaking conditions. When the heading has advanced seven to eight ft., bench holes placed and pointed as illustrated and are drilled to the full depth of the bench. In places, especially along the bottom bench, it is necessary to place lifter holes about 8 ft. long. The pairs of bench holes are usually



METHOD OF DRILLING FOR QUARRYING, LOW MOOR, VA.

placed upon about 7 to 8-ft. centers. Of course this ideal method can be only approximated in practice. After all the benches have been started, the breast is advanced by shooting one bottom bench first, then the next above and so on until all have been shot.

The drilling formerly was done with Ingersoll-Rand Little Giant D. M. No. 5, 3¼ in. piston drills, but in March, 1914, Ingersoll-Rand Butterfly Jackhamers, Model B C R 430 were introduced, and an immediate saving was evident. Now Jackhamers are used exclusively with ⅞-in. hollow hexagonal steel and cruciform bits.

When a hole is drilled to its full depth, it is cleaned with compressed air and loaded. Sticks of ammonia dynamite 1 x 8 in. are used, two sticks of 60% powder being placed in the bottom of the hole and 8 to 16 sticks of 33% powder above them. It has been found that the two sticks of 60% powder are very valuable in breaking the stone to a suitable size. Formerly 40% nitroglycerin dynamite was used entirely, but the 33% ammonia powder now in use seems even more effective and gives lower explosive costs per ton. The shots are fired by electricity, using 6-ft. electric exploders and No. 6 caps. The small amount of block-holing necessary is done with Jackhamers.

Loading now is done mainly by a Thew Automatic compressed-air shovel, No. 1 type, 1-cu.yd. dipper and a full circle swing. This shovel is about 27 ft. high, and this height must be considered when "break-throughs" under caves are to be attempted. Five-ton, steel drop-bottom cars are used, and about six dipper charges are needed to fill a car. Under favorable conditions the shovel digs and loads about 40 cu.yd. of stone per hour.

In addition to shovel loading, some hand loading is necessary occasionally, in cleaning benches and in loading small quantities of stone where it is impracticable to move the shovel.

Until August, 1916, mule haulage was used entirely, but now the mules have been replaced by a Whitcomb 7-ton 70-hp. gasoline locomotive. Though the cost of haulage has been lowered to some extent, one of the main reasons for the change was the shortage of labor. By the use of 5-ton cars and a motor, several men have been liberated for other work. All the grades in the present working places are in favor of the loads, and the maximum grade is about 6%. The motor is only used to pull back the empties and spot them at the shovel, the loads rolling by gravity to the dumping point. Nine 5-ton empties, each weighing about 7200 lb., can be hauled up a 6% grade. When 1½-ton wooden cars were used, they were dumped directly into the skip; but with the substitution of 5-ton cars the skip would no longer hold a carload, and a 5-ton skip is impracticable. So a small wooden steel-lined bin was installed, and now cars are dumped into the bin and skips are loaded from the bin chute.

The track is 36 in. gage, and 35-lb. rail is used except in the heading with a shovel, where 56-lb. rail was found

INTERIOR OLD UNDERGROUND LIMESTONE QUARRY, LOW MOOR, VA.

better. The cost of gasoline and oil for the motor is about $2.75 per day. About fifty 5-ton cars are loaded and hauled per day.

The rock is hoisted in 2-ton steel, self-dumping skips and dumped into a small bin in the rockhouse. From the bin the stone passes into a 36 x 18-in. Farrell, Blake type, jaw crusher set to 4 in.; thence over a $\frac{9}{16}$-in. round-hole, punched-plate screen, set at about a 30° angle, and into standard-gage cars. Beneath the screen is a chute over which is played a spray of water, washing the lime dust into the creek below. When a cave is encountered in the quarrying and mud becomes mixed with the stone, a spray of water is placed over the jaw crusher and over the plate screen, which reduces the insoluble by a percentage ranging from 1.5 to 4%. Hoisting is done in balance over 42-in. gage double track with 1-in. steel rope. A W. H. Barber, 40-hp., 48-in. drum, geared, reversible hoist is used.

No artificial ventilation is necessary because of the great height of the galleries and the numerous breaks to the surface. Even in the headings where the gasoline motor is used, the air is always good. Drainage is unnecessary, as the workings are dry the year round. These favorable conditions of ventilation and drainage of course form a large factor in maintaining low costs.

The lighting problem in the quarry has been solved in various ways. Prior to 1914, kerosene torches were used exclusively by the men underground. They were furnished to each man and kept supplied with oil free of charge by the company. This proved uneconomical and carbide lamps were substituted, the company selling the lamps and carbide to the men at cost. The advantage of better light and consequent better work was felt at once. In September, 1915, electric lights were installed in the main haulageways. The working face where the shovel is used is illuminated by a 500-cp. acetylene lamp, which gives excellent service. It is run during the day shift only and costs about $5 per month.

Surface Equipment, Costs and Improvements

At the surface the equipment includes a boiler and engine house, a blacksmith shop, an office and warehouse and a powder magazine. Steam for the various machinery is supplied by a 125-hp. Earle C. Bacon return-tubular boiler and by a 75-hp. Virginia Machinery Co. return-tubular boiler. Part of the compressed air used underground is brought from a 450-cu.ft. Ingersoll Rand compressor at the furnace and the remainder from a 650-cu.ft. Sullivan compressor at the quarry. Reheating of the air is sometimes necessary in winter. The blacksmith shop is equipped with a Leyner I. R. 33 drill sharpener, which sharpens and shanks bits for both the quarry and Rich Patch mines. In the office are installed a Bristol electric time-recorder for recording the number of trips of the skip and a Bristol pressure recorder for recording the compressed-air pressure.

Strange as it may seem, the total cost of quarrying a ton of stone today is much less than it was a few years ago, despite the increased cost of supplies, explosives and labor and the general decrease in output. The explanation of this is found in several general causes: Substitution of Jackhamers for the old-style piston drills; installation of motor haulage and larger cars; installation of a drill sharpener; increased efficiency of superintendence. Of these the first is of the greatest importanc, and the table below shows the effect of improvements since the Jackhamers were installed in March, 1914.

COMPARISONS OF COSTS

	Before March, 1914	Since March, 1914	Per Cent. Improvement
Drilling in feet per hour	4.82	10.5	118
Cost per ton for drilling and shooting	0.087	0.039	55
Total cost per ton, f. o. b. furnace	0.779	0.573	26.5
Total labor cost per ton	0.341	0.195	43
Cubic feet air per minute (drills)	616	460	75
Average monthly production	7,230	5,106	....
Average tons per day (shovel)	175	225	28.5
Pounds dynamite per ton of stone	0.718	0.534	25.5

Under the old system of drilling, the record for the lowest total cost per ton was 59.9c., while the record now at 38c. per ton is held by the present superintendent, A. L. Monteith, to whom credit is due for improvements.

A comparison of the detailed costs before and after March, 1914, will show more clearly the effect of improvements.

AVERAGE COSTS FOR 1913 AND 1916, LIMESTONE NO. 1

	1913	1916
Salaries	$0.027	$0.033
Labor	.296	.202
Explosives	.079	.074
Fuel	.035	.027
Supplies	.051	.031
Timber	.002	.000
Teams	.027	.015
Analyses	.000	.001
General Expense	.001	.001
Telephone	.002	.001
Depreciation	.044	.035
Taxes	.008	007
Insurance	.001	.000
Miscellaneous	.013	.000
Total f.o.b. quarry	$0.586	$0.427
Tons average monthly output	5,000	6,150

To enable the general office to follow the work of the quarry, daily reports are filled out in duplicate, one copy remaining at the quarry and the other being sent to the office of the manager of mines, where they are kept on file for reference. At the end of each month analyses of the limestone in insoluble and alumina are plotted in curves and general cost sheets are prepared. The superintendent also compiles and summarizes such data as drilled per ton of stone, dynamite per ton of stone, etc., as in the following typical table:

DETAILS OF OPERATIONS

Average number of men employed	17.9
Average tons of stone per man shift	11.3
Average tons stone loaded per day	203.4
Average tons stone per drill foot	1
Average tons stone per pound dynamite	2
Cost per ton stone drilling, shooting, and bench cleaning	$0.042
Cost per foot drilling, shooting and cleaning benches	$0.046
Cost per foot drilling only	$0.015
Estimated tons stone	4,690
Estimated cost per ton	$0.511

In this way very close watch is kept upon both the financial and the practical end of the work, and its effect is plainly shown in the low costs of extracting ore.

Labor at present is scarce and only moderately efficient. Roughly, half of the laborers are negroes and the other half are native whites, practically no foreign labor being used. Ordinary labor is usually paid about $1.75 per day. This wage is augmented by two bonus systems. The first, or "full time," bonus consists of $1 per half-month to each man who works full time. The second is a bonus based upon tonnage and cost. If tonnages and costs are favorable, a bonus of one cent per ton is divided among all men employed in proportion to their wages earned. This latter system will be changed in the near future to a steady scale based on tonnage and costs, whereby with decreasing costs the bonus is increased. Occasionally a special bonus is granted to men who do especially good work. A 10-hour day six days a week is the standard at the quarry, but part of the time two 10-hour shifts are worked.

Cyaniding at Comacaran Mines, Central America

By William M. D'Arcy*

SYNOPSIS—Description of the cyanidation means installed at the Comacaran Gold Mines in Salvador, Central America, in 1913 and still in successful operation. An approximate flow sheet of the cyanide mill is shown. The treatment follows standard practice.

Cyanidation of the ores of the Comacaran Gold Mining Co., at El Hormiguero, Salvador, Central America, has been in successful practice for the past four years. The purpose of this article is to give an account of actual operations covering the period from the date of completed installation to March, 1917, when I, having installed the plant and occupied the position of mill superintendent, left Salvador for Australia.

The principal owners of the property are Emilio and Benjamin Gonzalez, brothers, the former being resident manager and the latter president of the company. Both have progressive ideas, and it is due to their untiring efforts for improvement that the property is today the leading mine in Salvador. Charles P. Richmond, M. E., took charge of the property as general superintendent in January, 1913, at which time I was employed as chemist and mill superintendent.

The ore milled is delivered from three mines—Gallardo, Hormiguero and Guadalupe—by aërial tramways. The ore from the Hormiguero consists of hard-quartz gangue, the principal value of which is in silver occurring as sulphide. The ore from Gallardo contains considerable calcite and is soft and friable, the principal value being in gold. The Guadalupe ore is highly oxidized, containing some manganese and iron, the metal of principal value being gold. This ore is very soft and has a tendency to slime heavily.

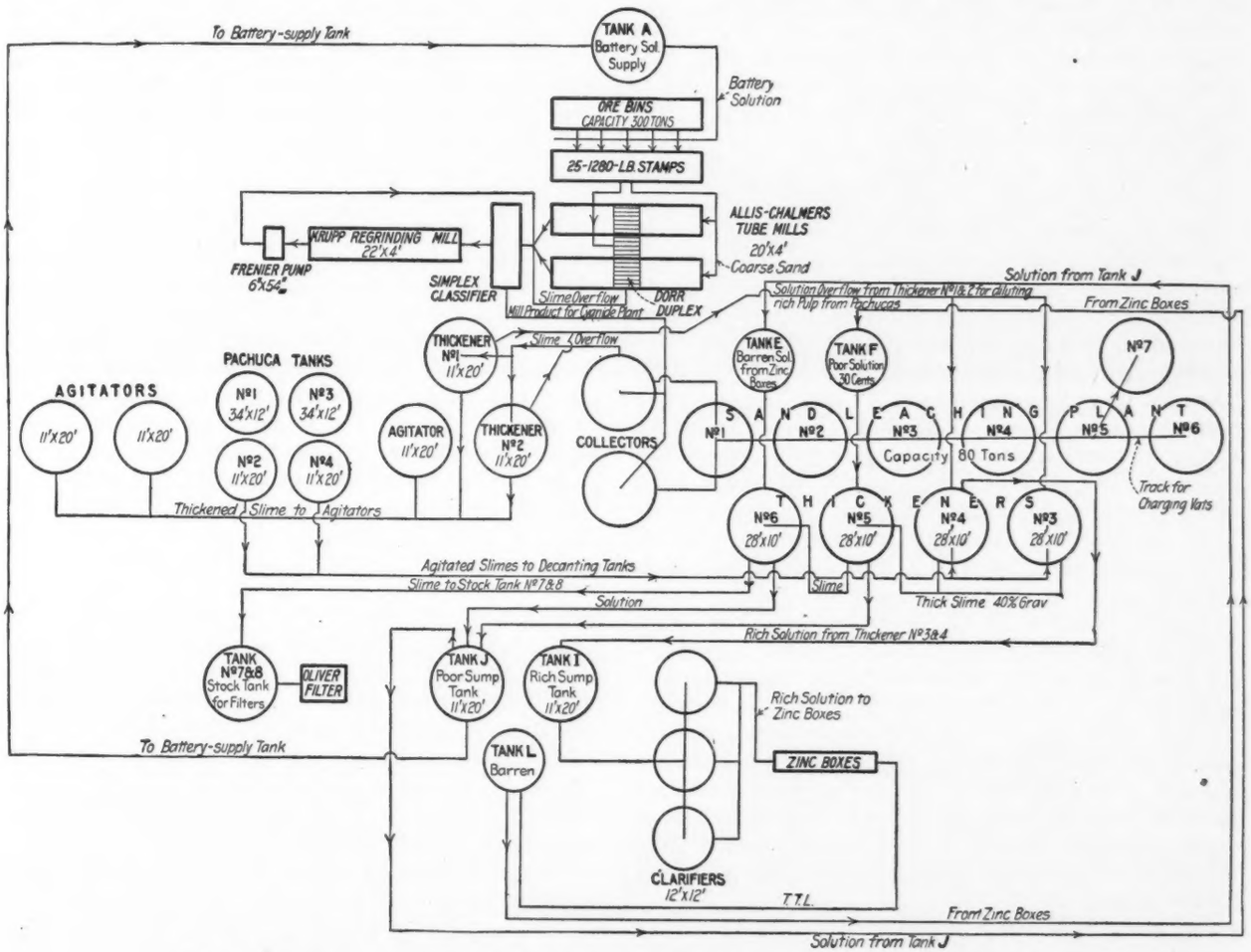


DIAGRAM SHOWING THE FLOW OF PULP AND SOLUTIONS AT THE COMACARAN MILL

The delivered ore is passed through 1½-in. grizzlies, the undersize going directly to the ore bins, the oversize being fed by hand to two Blake crushers. The ore from the mill bins, which have a capacity of 300 tons, is fed by Risdon suspended-type feeders to 25 stamps of 1280 lb. each, making 101 drops per min. 6½ in. The ore is crushed in cyanide solution (20 lb. to the ton) to a 3-mesh screen by the stamps. The lime is also fed

*Mining engineer, Brisbane, Queensland, Australia.

in with the dry ore. This product then goes to one Dorr duplex classifier, the sands from this being fed to two Allis-Chalmers 20 x 4-ft. tube mills. The product from these mills goes to a Dorr simplex classifier, the sands of which go to a Krupp 20 x 4-ft. tube mill for regrinding and are then thinned by the slime stream from the duplex classifier. The slimes from the Dorr simplex and the Krupp product go direct to the cyanide department.

Before taking up the cyanide treatment, it may be well to state that the grinding in the tube mills is done by especially prepared hard-quartz boulders obtained at the mines. The preparation of the boulders is accomplished in a home-made barrel tube mill made from an old feed-water heater lined with rails. This rounds off the sharp edges and leaves them in the approximate form of an egg. Before this method of preparation was employed, the boulders were fed direct to the mills, but it was observed that the sharp edges would break off and pass out of the mills about the size of marbles. This of course affected the efficiency of the mill for grinding and also interfered by chocking the regrinding mill. The idea of preparing the boulders as mentioned was introduced into this mill by Frank T. Fox, in charge of the crushing department.

Cyanide Treatment and Slimes Handling

The product, as it is delivered from the batteries, goes to two sand collectors. The slimes from the collectors go to two home-made thickeners, 11 ft. and 20 ft. in diameter respectively. The thickened pulp is conveyed to one of three mechanical agitators by an air lift. The density of this pulp is about 28% dry slime (sp.gr. 2.5). The capacity of these agitators is 120 tons. As soon as an agitator is filled, which takes about 8 hours, the specific gravity is taken to determine tonnage of dry slime and solution. The solution is titrated for KCN and CaO, and corrections are made to bring the solution up to 2.5 lb. KCN and 1.5 lb. CaO. The approximate time of mechanical agitation is 16 hours. From here it is pumped, charge by charge, to one of four Pachuca tanks, 34 x 12 ft., using 30 lb. air pressure for the four tanks, three of which are agitating all the time and one lowering to a series of Dorr thickeners. The average time of agitation in the tanks is 24 hours. The pulp from the Pachuca tanks goes by hydrostatic head to thickeners 3 and 4, where it is diluted by the overflow of thickeners 1 and 2. The pulp from these two thickeners is pumped to thickener 5 by means of an 8 x 48-in. Frenier pump, where it is again diluted by a poor solution obtained from the tank *F*, the average of which is 30c. The pulp from here is passed to thickener 6 by a same style Frenier pump, where it is diluted by a barren solution from the zinc boxes. After leaving this tank the pulp is pumped to tanks 7 and 8, containing a pulp of 40% sp.gr. These two tanks act as stock tanks for the filter plant, which consists of one 75-ton Oliver filter and one 25-ton Butters filter.

The filtering is the governing factor in the capacity of the plant. With larger filtering capacity the crushing department can take care of more tonnage. With this particular ore it has been proved that an Oliver filter will not handle its rated capacity on account of the rapidly forming lime crust on the filter cloth, and also the atmospheric action which causes the formation of carbonate of lime. This necessitates cleaning and scrubbing of the filter media every few days, which retards the capacity of the plant through delay in cleaning.

The sands from the collectors are trammed in cars to leaching tanks of 80-ton capacity, there being seven of them. As soon as the vat is charged, the sand is leveled and raked over and 80 lb. of crude KCN is put under the drain-cock and a stream of barren solution containing 2.5 lb. KCN is turned on and the crude KCN is dissolved. The drain-cock on the leaching pipe is then closed, and the charge is allowed to stand for 12 hours, when the drain-cock is half opened and the charge allowed to aërate for 12 hours. This is repeated for two days, and then an undissolved-value sample of the charge is taken and assayed. After this sample is taken, the charge remains idle until the assay is received to determine whether or not the charge needs another application of KCN. If not needed, the barren-solution wash is then started and applied every four hours until within 24 hours of the discharging time, when the water wash is commenced and applications given every two hours. Four hours before the vat is to be discharged, the water wash is stopped and vacuum is applied through the leaching pipe. This draws the remaining moisture out of the sands so that they are discharged at about 15% moisture.

Solution Handling and Precipitation

The rich solution is obtained from the overflow of thickeners 3 and 4, which goes to a settling sump marked T. I. From there it is pumped by a single-stage centrifugal pump to a set of three clarifier tanks, 12 x 12 ft. each, having a basket of 15 leaves of the Butters type suspended in them and connected to a wet-vacuum pump.

From the distributing barrel the rich solution passes through five zinc boxes of standard make at the rate of 8.3 tons per hour per box, the tails averaging 3c. per ton by assay. The tail solution is collected in a sump called T. L., and from there it is pumped to T. E., which served as a wash tank for thickener 6, the last of the series of thickeners before going to the filters. From thickener 6 the overflow solution is run down to another sump marked T. J., and from there is pumped by a two-stage centrifugal pump to the head of the mill to supply the batteries with solution. This solution, after being added to the batteries and classifiers, goes with the pulp to thickeners 1 and 2, the overflow, as stated, going to thickeners 3 and 4 to dilute the rich pulp from the pachucas. This solution in turn goes to the zinc boxes. With this system of flow of solution, it is the object to precipitate all solutions in one cycle through the mill.

The zinc boxes are dressed twice a week, the rich gold slime being collected in a tank 52 x 48 in. at the foot of the zinc boxes and below them. This tank has a false bottom in it 24 in. above the bottom and a vacuum line 2½ in. in diameter, connected below it. The slimes are run by gravity to it from the zinc boxes, and when the tank is full the vacuum is turned on and the solution drawn through the false bottom leaving the slime on top. The slimes are then fluxed with 8% borax, 6% bicarbonate of soda and 8% assay slag, and slacked up in sacks made out of the old cloths of the Butters filter leaves, the lime being washed out of it first. From there it is fed into a Monarch tilting furnace, 4500 oz. of precipitate being required to make a bar of 2000 oz. The bars are smelted one at a time.

New Tramway at the Tacoma Smeltery

By W. C. Kuhn*

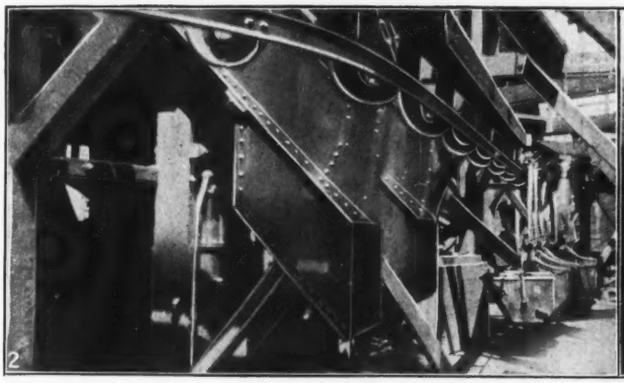
SYNOPSIS—Tramway constructed for storage or bedding of ores, with tripping arrangement for discharge of buckets at any point. Capacity 100 tons per hour, buckets carrying approximately 2500 lb. each leave the automatic loading station every 36 seconds.

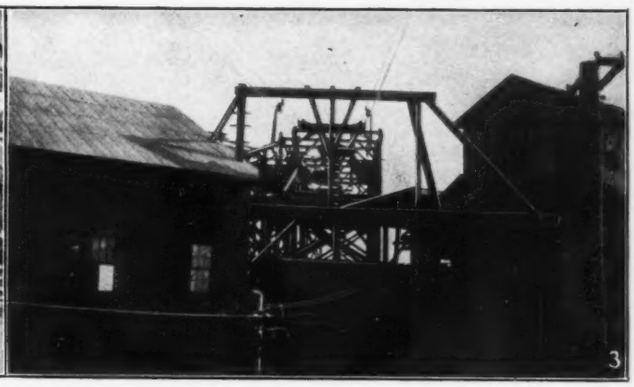
The Tacoma Smelting Co. at Tacoma, Wash., has a large smelting plant, but in spite of its magnitude is not in a position to smelt ores as fast as they are received. It is therefore necessary to store ores in the yard until such time as they can be treated. As received, they vary considerably in composition and grade and must therefore be stored in separate piles. As the storage space is somewhat limited in area, a device capable of forming high piles and distributing in a satisfactory and economical manner had to be installed. This device also had to be capable of placing material on piles whether arranged consecutively or not, as the storing of two or more grades of ore at one time might be required.

The undertaking was submitted to the engineers of the American Steel and Wire Co., whose plans and specifications for an aërial wire rope tramway of the Trenton Bleichert line type to meet the conditions were accepted.

*Tramway engineer, American Steel and Wire Co., 30 Church St., New York.

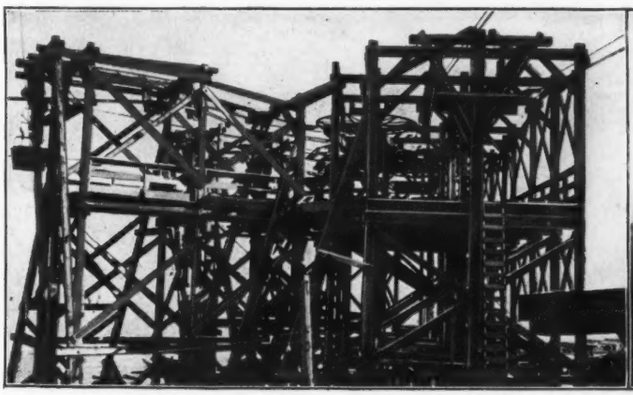
The tramway is 2850 ft. in circuit. Beginning at the loading terminal, it extends in a straight line a distance of about 360 ft. to an angle station, where it makes a 53° turn, and from this point the two lines of track cable diverge and extend for a distance of about 1000 ft., at which point they are about 120 ft. apart. This permits of the tramway covering a storage space 1000 ft. long by 120 ft. wide at one end and about 25 ft. wide at the angle station or the opposite end (Fig. 1). All supports, beginning with the angle station, are about 60 ft. high, permitting the forming of storage piles about 50 ft. high. Under each line of cable over the storage ground there are two supports, giving six spans of about 300 ft. each. On each of these spans there is a tripping device known as an ambulating tripping frame, which automatically trips the buckets as they pass.

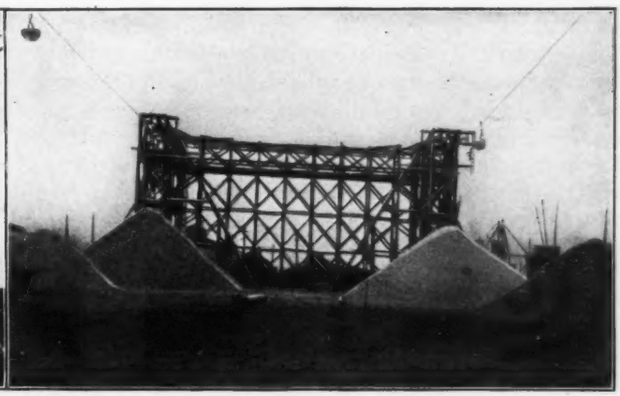




FIGS. 2 AND 3. LOADING CHUTES AND GRIPPING DEVICE FOR BUCKETS, TACOMA SMELTING CO. TRAMWAY

The tripping frames are an interesting and clever device in that they are so arranged as to be selective. That is, the tripping lever can be set so as to trip only those buckets on which the tripping mechanism has also been adjusted to engage with the lever on this frame. All buckets not so adjusted pass this frame and are tripped at the frame for which they are adjusted. The tripping frames are equipped with rollers so as to be easily shifted from place to place on their respective spans to dump ore over different storage piles. All these devices serve to promote easy operation.





FIGS. 4 AND 5. ANGLE TOWER AND OUTER TERMINAL, TACOMA SMELTING CO. TRAMWAY

Fig. 6 will illustrate the tripping frame in the act of dumping a bucket of ore, and it also shows in the distance one of the intermediate supports through which another bucket is passing. Attached to the bottom of the tripping frame are guy ropes extending to the ground, the purpose of which is to hold down the frame and track cable, thereby preventing surging due to sudden release of the load in the bucket. A fifth line, extending from the frame to the ground, shifts the position of the tripping lever from clear to proper position to engage the tripping levers on carriers. The buckets are of 14-cu.ft. capacity and are intended to hold 2000 lb. of ore weighing about 150 lb. per cu.ft. As a matter of fact the ore they have been transporting weighs 182 lb. per cu.ft., and therefore the load in the buckets has been around 2500

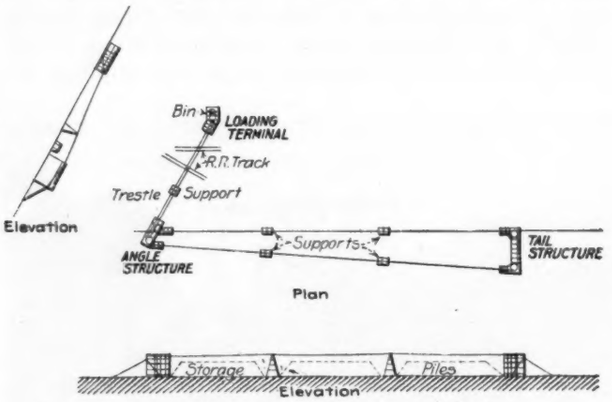


FIG. 1. PLAN AND ELEVATION, TACOMA SMELTING CO. TRAMWAY

lb. The tramway was designed for a capacity of 100 tons per hour and was operated at 105 tons per hour in the initial tests.

In order to operate at 100 tons per hour it was necessary that a bucket of ore leave the loading station every 36 seconds. This necessitated some device for loading the buckets that would operate quickly and easily. The American Steel and Wire Co.'s engineers, therefore, designed what is known as the Wico rocking power chute, to be operated by air. This chute has a compartment holding one-half the capacity of the bucket, requiring two operations of the chute to fill the bucket. As the upper portion of the chute is filled the operator turns a valve supplying air to the compressed-air cylinder which rotates the bottom and sides of this chute, allowing the material to flow into the bucket. At the same time an undercut gate is forced up through the ore, cutting off the supply from the bin. An adjustable sliding gate between the undercut gate and the bin controls the flow of ore from bin into chute. The advantages of this type of chute are its quickness of operation, freedom of gate operation and prevention of overloading of bucket. On the front of the chute is a swinging gate which prevents material shooting across the bucket, shown in Fig. 2. One particularly interesting point in connection with this chute is the advance that has been made in the cutoff gate. This gate is arranged so as to cut off the supply of ore from the bin, with an ever-receding angle which allows the gate to close without blocking.

After the buckets are loaded, they are attached to the traction rope by patent grips which are mechanically closed by passing through an attacher. The position of the grip used is illustrated in Fig. 3. This gripping device, it will be noticed, is an integral part of the carriage. The grip jaws, which extend above the carriage, permit operating around curves without detaching from the traction rope. The flange of the traction-rope sheave rests against one of these jaws, depending in which direction the curve is made. When closed on the rope, this grip forms a safe and secure connection between rope and carrier.

After being dispatched from the loading terminal, the carriers require no further attention until their return to this terminal, where they are automatically released from the traction rope and coast to the point of loading. The carriers pass around 12-ft. diameter sheaves in the angle station and the two outer angle towers, without detaching from the traction rope (Fig. 4).

The buckets are of the self-righting type, so that after automatically discharging their contents, they right themselves and return to the loading terminal ready for reloading. The tramway is driven by an electric motor, 13 hp. being required to operate the line when running to full capacity. Track cables are of the well-known

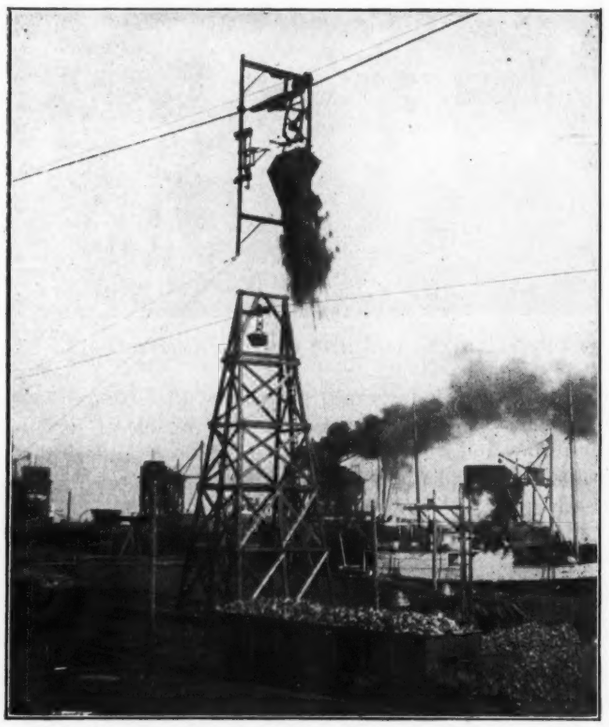


FIG. 6. TRIPPING FRAME AND AN INTERMEDIATE STATION ON TACOMA SMELTING CO. TRAMWAY

Trenton locked-coil construction, $1\frac{5}{8}$ in. diameter on all portions of the line on which loads are transported and 1 in. diameter on the returning side between the angle station and the loading terminal, over which only empty buckets pass. The traction rope is $\frac{5}{8}$ in. diameter, 6 x 7 Lang Lay crucible cast steel. This runs at a speed of 250 ft. per min., a comparatively slow speed, to permit of the carriers passing around the curves in the angle structures without jarring or bumping. Fig. 5 shows the structure at the outer end of the line. Material is taken from the piles with a locomotive crane, loading railroad cars.

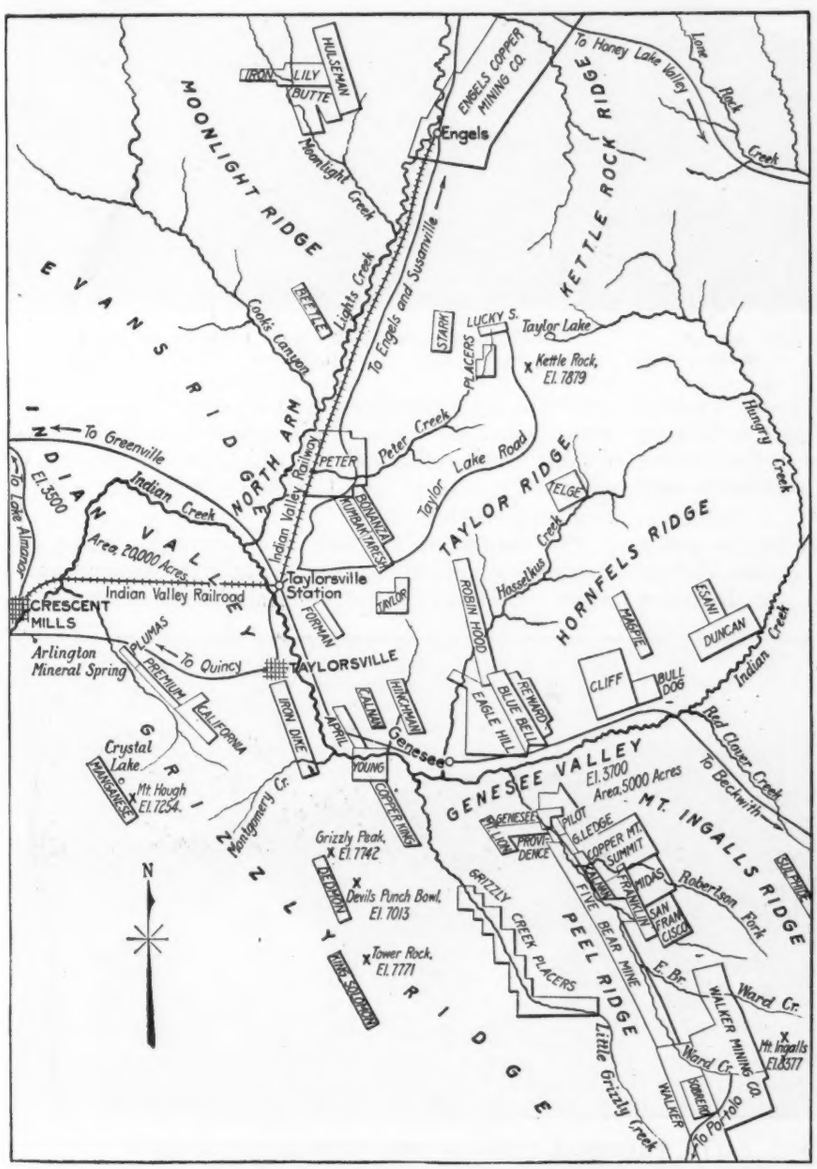
From the description given it will be seen that this is a tramway of a most special design, but it is only one of the many specially designed tramways that have been furnished by the American Steel and Wire Co.

The Plumas Copper Belt

By G. H. Goodhue*

SYNOPSIS—The Plumas copper belt extends for about 60 miles through Plumas County, California. Progress in development is being made among actual and would-be producers. Railroad extension and power-plant construction in contemplation and erection will materially increase the intrinsic value of the properties. Details are given in the following article.

The Engels mine, situated 12 miles north of Taylorsville, Plumas County, California, is the principal producer in the Plumas copper belt. It is operated by the Engels Copper Mining Co., of San Francisco, Mr. Reinmiller being resident manager.



MAP OF PLUMAS COUNTY COPPER BELT

The daily shipments of concentrates average 30 tons, with over 30% copper. Grading is being done for a 2000-ton flotation mill to be completed and in operation by next June. Underground development continues on an extensive scale; ore reserves exceed 2,000,000 tons.

The Beetle mine, 10 miles north of Taylorsville, is operated under bond and lease by Trask & Coffer, of Copperopolis, Calif., with Mr. Ronan as resident manager. Fifteen men are employed, and frequent shipments of ore yielding $180 to $200 per ton have been made during the last year. The Peter mine, five miles north of Taylorsville, was recently bonded to the United States Smelting and Refining Co., and the work of unwatering the shaft will be commenced in April. W. W. Adams is the resident manager for the United States Smelting and Refining Co. in Plumas County, with headquarters at Taylorsville. The principal properties held by this company are the Five Bears, Eagle Hill, Robin Hood, Providence and Cliff mines at Genesee and the Iron Dike at Taylorsville. These holdings aggregate about 2000 acres. The Iron Dike mine, where about 20 men are employed, is situated one mile south of Taylorsville. A compressor has been installed, and the main tunnel is being driven to develop the mine to a depth of 1200 ft. A new body of high-grade pyritic ore, 12 ft. wide, has been cut in the tunnel. At the Five Bears mine, three miles southeast of Genesee Post Office, a width of 45 ft. of concentrating ore, 12 ft. of which averages 7% copper, has been cut by crosscutting east from the main tunnel, 1400 ft. from the portal and at a vertical depth of nearly 1000 ft. Twenty-five men are employed, and this force will soon be increased to 50. Goodhue Brothers, of Genesee, recently made a 10-ton shipment from the Pilot mine averaging $12 gold, 30 oz. silver and 19% copper. This property adjoins the Five Bears mine on the north. The Walker mine is six miles southeast of Genesee Post Office. It is operated by the Walker Mining Co., of Salt Lake City, and about 140 men are employed. A 100-ton flotation mill is in operation and in addition to the concentrates produced, a quantity of high-grade ore is shipped to the International Smeltery at International, Utah. Portola, 24 miles distant on the Western Pacific R.R., is the shipping point for the mine. The company will install a 900-hp. electric plant on Ward Creek this season.

H. L. Huston, of San Francisco, Calif., has taken a bond on the Cooper Mountain group of 36 claims, situ-

*Indian Falls, Calif.

ated on Cooper Mountain near the Five Bears mine at Genesee, and is driving a tunnel to open the Cooper vein at a depth of 1000 ft. below the old workings. A considerable amount of high-grade copper ore was shipped from this property during the Civil War.

The construction of the Indian Valley Ry., a feeder of the Western Pacific, will be an important factor in the development of the Plumas copper belt. This railroad is 26 miles long and runs from Paxton Station on the Western Pacific to the Engels copper mine. It is now completed within six miles of the Engels mine, and freight

LOOKING SOUTHEAST FROM CRESCENT MILLS
1—Iron Dike. 2—Eagle Hill. 3—Five Bears. 4—Walker mine

LOOKING NORTHEAST FROM CRESCENT MILLS
1—Engels mine. 2—Stark mine. 3—Peter mine

shipments are being made over this section. Taylorsville station, six miles from Genesee, will be the shipping point for the Five Bears and other mines in the Genesee Valley until a spur is built to Genesee, probably next summer.

The Great Western Power Co. is erecting a power transmission line from the power plant at Las Plumas on the Feather River into Indian Valley, for the mines

TAYLORSVILLE, PLUMAS COUNTY, CALIF., PRINCIPAL TOWN OF THE PLUMAS COPPER BELT

on the copper belt. The line will be completed by May 1, and will transmit 8000 kilowatts.

With the present prices for metals, and the fact that the mines have been very profitably operated during the past year without adequate means of transportation or without the services of the new power company, the present year should be a banner one for the district.

Rock Classification for Engineering Contracts

The need of an accurate classification of the rocks involved in proposed engineering work is not always appreciated by the engineers and contractors in charge, says Graham John Mitchell, in *Economic Geology*, April-May, 1917. To illustrate this point, the following incident is cited:

A Western railroad, became involved in a lawsuit, brought by a contractor who had graded several miles of roadbed. Rock classification in his contract was: Loose rock; material which can be removed with pick and shovel: Soft rock; material which can be removed by plow and scraper without blasting: Hard rock; material requiring blasting.

The contractor claimed more yardage under the hard-rock classification, than the railway company would allow. Geologists found the material encountered consisted of tufaceous sandstone, shale, and weathered rock matter. This information could have been secured before the contract was let and exact classification made and price set. There are doubtless many instances where the initial precaution of engaging a geologist to determine formations before letting out grading contracts would mean a saving to the company concerned.

Metallurgy of Ferromanganese*

SYNOPSIS—Ferromanganese is used largely in iron and steel metallurgy, acting as a deoxidizer in producing sound, homogeneous steel. Ferromanganese and spiegeleisen differ in percentage of manganese contained. The production of the iron-manganese alloys is a new domestic industry, born of the war conditions that made its importation impossible.

Ferromanganese ranks first in importance among alloys employed in the iron and steel industry. Its industrial importance arose shortly after 1856, when the bessemer process, requiring a strong deoxidizer to make sound homogeneous steel was introduced. The use of manganese in steel manufacture dates back to 1839, when it was used by Heath to improve malleable iron and cast steel made from certain low-grade iron ores. Heath noted that the manganese addition made the treated product more malleable and weldable, the addition being made in the form of dried bricks made of a mixture of manganese oxide and tar. A triple alloy of iron, manganese and carbon, invented by Robert Mushet soon after 1858, which was essentially spiegeleisen, was used extensively in the bessemer converter in the early days.

Ferromanganese containing 24 to 30% manganese was first produced for commercial use in 1865 by Henderson,

TABLE I. ANALYSES OF MANGANESE ALLOYS

	Percentage analyses of iron-manganese alloys.								
Alloy.	Mn	Si	Fe	Gr.	C.C.	T.C.	P.	S.	Authority
Spiegeleisen.....	8.11	1.10	86.52	...	4.27	....	....	....	a
Spiegeleisen.....	9.25	0.44	.....	...	....	3.95	0.060	ti	b
Spiegeleisen.....	14.40	0.56	.....	...	....	4.32	0.063	nil	b
Spiegeleisen.....	19.74	0.52	74.96	...	4.78	....	....	....	a
Spiegeleisen.....	20.11	0.42	.....	...	....	4.99	0.074	nil	b
Spiegeleisen.....	29.75	0.65	.....	...	....	5.20	0.090	nil	b
Ferromanganese..	41.82	0.42	52.13	...	5.63	....	....	....	a
Ferromanganese..	60.00	0.60	32.80	...	....	6.40	0.10	0.005	b
Ferromanganese..	70.00	0.70	22.30	...	....	6.80	0.14	0.005	b
Ferromanganese..	80.00	0.80	11.20	...	....	7.20	0.18	0.004	b
Ferromanganese..	80.04	0.97	12.46	...	6.53	....	....	....	a
Ferromanganese..	80.04	0.14	12.62	...	7.20	....	....	....	a
Ferromanganese..	80.20	1.16	11.80	...	....	6.46	0.38	....	c
Silico-spiegel.....	19.64	10.74	67.44	0.33	1.85	....	....	....	a
Silico-spiegel.....	19.74	12.60	66.01	0.67	0.98	....	....	....	a
Silico-spiegel.....	23.90	4.90	67.66	...	3.56	....	....	....	a
Silico-spiegel.....	24.36	15.94	58.50	0.90	0.30	....	....	....	a
Silico-spiegel.....	50.00	4.20	43.24	...	2.56	....	....	....	a
Silico-manganese.	55.00	24.10	19.00	...	....	0.35	0.04	0.02	d
Silico-manganese.	70.30	24.60	3.80	...	....	0.35	0.04	0.02	d
Silico-manganese.	74.20	24.10	0.77	...	....	0.30	0.02	0.01	d

a. Hadfield, R. A., "On Alloys of Iron and Silicon," "Journal Iron and Steel Institute," 1889. No. 2, p. 226.
b. Carnegie, D., "Liquid Steel," pp. 42, et. seq.
c. Jakoki, J., "Ferromangen in Hochofen," "Stahl und Eisen," Vol. 29, 1909, p. 1191.
d. Lyon, Keeney, and Cullen, "The Electric Furnace in Metallurgical Work," U. S. Bureau of Mines, Bull. 77, 1916, p. 146.
Photomicrographs of high-speed steel hardened at different temperatures.

closely followed by Prieger, of Bonn, Germany, who made a 75% manganese alloy in the crucible. A company at Terre-Noire, France, improved upon these earlier methods a little later and made ferromanganese by a combina- process using the openhearth furnace and the crucible. Prior to 1873 no ferromanganese had been made in the blast furnace, but about this time a 33% manganese alloy was produced by this method in Sweden. At Terre-Noire, in 1875, Pourcel made a 75 to 80% manganese-iron alloy in the blast furnace, and since then, until about five years ago, all ferromanganese has been made in this way. At present a small tonnage is being made in the electric furnace, notably in this country at Heroult, Calif.

*By Robert J. Anderson, in "Iron Trade Review," Mar. 29, 1917, by courtesy of the publishers.

Ferromanganese and spiegeleisen are both alloys of iron and manganese, containing in addition carbon and usually silicon, as well as minor impurities in subordinate amount. Silico-spiegel and silico-manganese are similar alloys containing silicon in comparatively large percentages. Strictly speaking, spiegeleisen includes all iron-manganese alloys containing less than 20% manganese; ferromanganese is the term applied to such alloys containing from 20 to 80% or more manganese. Carbon is usually present in varying percentages, unless the ferromanganese is the carbon-free product of the Greene Wahl or the Goldschmidt alumino-thermic processes, and ranges up to 7% in the high-grade manganese-iron alloys. Silico-manganese is an alloy developed since the electric furnace came into use and has found some application in steel metallurgy. It is a strong deoxidizer, low in carbon, which makes it more advantageous to use than the high-carbon bearing alloys. Table I gives analyses of spiegeleisen, ferromanganese, silico-spiegel and silico-manganese.

Constitution and Properties

The exact nature of the manganese-iron-carbon alloys is as yet imperfectly known. In view of the necessity for the wide use of ferromanganese in so many metallurgical processes, it seems to be a singular fact that its composition is not definitely understood. Manganese has a great chemical affinity for carbon, and lately Moissan produced a manganese alloy in the electric furnace containing 14.59% of carbon. Manganese is thus capable of dissolving a large amount of carbon in excess of that required for the simple carbide, Mn_3C, and the excess does not apparently exist in the graphitic state. The amount of carbon absorbed is dependent on the temperature of the melting, increased temperatures promulgating increased percentages of carbon in the alloys.

Until the work of Carnot and Goutal in 1900, ferromanganese was regarded as a mixture of definite carbides; their constitution was purely imaginary as far as any real knowledge was concerned. These workers separated several double carbides from different ferromanganese and spiegeleisen samples and have deduced that: The carbide $Fe_3C.4Mn_3C$ exists in ferromanganese having 85 to 74% Mn; the carbide $Fe_3C.2Mn_3C$ exists in ferromanganese having 74 to 60% Mn; the carbide $2Fe_3C.Mn_3C$ exists in ferromanganese having 60 to 30% Mn, and the carbide $4Fe_3C.Mn_3C$ exists in ferromanganese having less than 18% Mn. The last carbide is probably present in spiegeleisen and cast iron.

Both ferromanganese and spiegeleisen are white or light gray in color with a brilliant metallic luster. Spiegeleisen is known as "mirror iron" from its brilliant, platelike, crystalline structure. Ferromanganese is granular and compact at times, and the cystalline structure is often prismatic and less often platelike. It has been found that a single mass of ferromanganese is not homogeneous as to composition. The manganese in samples from the different parts of the same cast has been known to vary more than 2%.

When steel contains an appreciable amount of manganese, as is the case with most commercial steels, part at least of the managenese forms Mn_3C, and this unites with the Fe_3C to form manganiferous cementite.

Both ferromanganese and spiegeleisen are still produced almost entirely in the blast furnace. Prior to the war but one company in this country made ferromanganese, the greater portion of the alloy being imported from England, and in lesser amount from Germany. During 1915-16, when the imports of both manganese ore and ferroalloys from Europe were cut off by embargoes and shipping conditions, a number of furnaces started making these alloys, and in fact, a new domestic industry was reared in the United States.

Spiegeleisen, the lower-percentage alloy, has been made in this country for a number of years and chiefly by the New Jersey Zinc Co. from the manganiferous zinc residuum obtained in zinc smelting. High-grade Brazilian ores are now being used for the production of the high-percentage alloy. Manganiferous iron ore from the Cuyuna Range has also been utilized.

Spiegeleisen is usually made in the iron blast-furnace stack, the source of manganese in the charge coming from manganiferous iron ore, from a mixture of manganese and iron ores in the proportion of the percentages of manganese and iron required in the product, or from the manganiferous residuum from zinc roasting. As the percentage of manganese in the product increases, the heat required for smelting increases likewise. The blast-furnace stack is fed with the manganese ore as well as limestone, coke and iron ore. The chemical reactions in the furnace are similar in every respect to those taking place when the stack is making pig iron: In the upper zone of the stack the higher manganese and iron oxides are reduced to lower ones with the production of FeO and MnO, which are in turn reduced to elemental iron and manganese by incandescent carbon. The stack is usually run on a strongly basic slag and under hot blast. Fuel consumption is high and may go to 5000 lb. of coke per ton of alloy produced. The output of an average furnace may be about 35 tons of the 80% alloy in 24 hours. In addition to high fuel consumption, the cost of production is augmented by the usual loss of manganese in the slag and fume. In a blast-furnace run in Germany on ferromanganese, 6.7% of the metal was lost in the slag and 18.4% was volatilized as fume or lost as dust. The results of this run are given in Table II. The average loss of manganese by volatilization as fume, or as dust, may vary from 15 to 30% of the total amount of manganese charged. The average loss due to the foregoing and to that which goes to the slag is about 30%. The phosphorus goes mainly to the alloy, but the lime in the charge removes the sulphur as calcium sulphide practically entirely. The burden is dependent on the nature of the ore charged; some of the Brazilian ores from Minas Geraes and the Poti ores from the Russian Caneaus are notably low in impurities. In general, the phosphorus in the burden should not exceed 0.002% for each 1% of manganese in the ore.

TABLE II. RESULTS OF BLAST-FURNACE RUN

Constituent	Percentage
Mn	51.6
Fe	1.45
P	0.173
SiO_2	7.80
Al_2O_3	1.12
CaO	1.80
MgO	2.18
BaO	2.20
Slag	
SiO_2	30.32
FeO	1.41
MnO	8.52
Al_2O_3	10.88
CaO	41.34
MgO	2.96
P_2O_5	0.01
CaS	3.94
BaO	0.48
Ferromangancse	
Mn	20.20
Fe	11.80
Si	1.16
P	0.38
C	6.46

From Jakoki, J., "Ferromangcn in Hochof n," "Stahl und Eisen," Vol. XXIX, 1909, p. 1191.

When ferromanganese is made in the electric furnace, manganese oxides and iron oxides, or manganese ore, and suitable fluxes, such as fluorspar, are mixed with powdered carbon, anthracite coal, etc., and heated until the reduction is completed. The metallurgical reactions are similar to others where carbon is the reducing agent, but the electric current produces a higher working temperature. The furnaces are ordinarily designed for resistance heating, being of the shaft type with a square cross-section and lined with refractory material. The charge, consisting of ore, coke and flux in a state of fine comminution, is charged at the top of the furnace, and the molten alloy is tapped off at the bottom periodically. The Greene Wahl and alumino-thermic processes are employed in the manufacture of carbon-free ferromanganese. Ferromanganese made in the electric furnace has a much lower carbon content than the blast-furnace product; it is also used in the molten state by ferroalloy manufacturers for the production of silico-manganese.

Manufacture of Silico-Manganese

As already mentioned, silico-manganese is an alloy developed since the application of the electric furnace to ferroalloy manufacture. Ferromanganese is made in an electric resistance furnace and ferrosilicon in a separate arc furnace. The two products are then mixed in a ladle while molten, to form the silico-manganese of the desired percentage of the elements contained. Ordinarily, 85% ferromanganese is made and the percentage of ferrosilicon depends on the percentage of iron called for in the finished silico-manganese. The alloy is also made by smelting a mixture of substances that will produce the desired silico-manganese in one furnace. Manganese volatilization loss is heavy in this method, but it appears to be preferable to the first-mentioned because of the fact that it is more rapid and also only one furnace is needed. Another method for the manufacture of silico-manganese is to reduce rhodonite, $MnSiO_3$, in the electric furnace, using carbon for the reduction. In this process coal or coke is mixed with rhodonite containing 38% of manganese in the ratio of 6 parts ore to 1 fuel. In general, two or three grades of silico-manganese are produced, such as 68 to 75% manganese and 20 to 25% silicon, and 50 to 55% manganese and 30 to 35% silicon. The carbon present in these alloys is low on account of the action of the silicon opposing the formation of combined carbon, with the consequent throwing down of graphite, which, owing to its low specific gravity, rises through the molten bath and accumulates at the surface. Carbon will be in the combined form when less than about 18% silicon is present; when more than that percentage of silicon is contained, any carbon present in the alloys will be in the form of graphite.

Ferromanganese and spiegeleisen are used in the metallurgy of iron and steel in these ways: (1) As deoxidizers, the iron oxide being reduced, returning iron to the bath, while the manganese oxide formed goes into the slag; (2) as recarburizers, for incorporating carbon into

the steel, by reason of their contained carbon; (3) for removing sulphur and phosphorus by the formation of manganese sulphide, and manganese phosphide in lesser degree; and (4) in the manufacture of manganese steel. The greater part of the ferromanganese alloys made, however, is employed for the deoxidation and recarburization of bessemer and openhearth steel. In iron-foundry practice, ferromanganese is used for strengthening and purifying hard iron or for chilling castings.

The basis of modern liquid-steel manufacture is dependent upon the functions of the manganese alloys. In foundry practice manganese alloys are used as deoxidizers and desulphurizers and also to alter the constitutional structure of the metal. In steel-works practice they are employed as deoxidizers and recarburizers as well as to impart certain static properties to the steel. In bessemer practice, during the final stages of the blow there is an incipient oxidation of the iron with the formation of ferrous oxide, which is soluble in the molten bath. In openhearth practice, the dissolved gases and oxides appear in the bath, although not to such an extent as in bessemer metal because the mode of manufacture is different.

Action of Manganese Added to Molten Iron

When manganese is added to the molten iron in the form of one of its ferroalloys, the element seizes the oxygen of the iron oxide with great avidity, the reason for this action lying in the greater chemical affinity of manganese for oxygen than of iron for the same element. The manganese oxide thus formed is insoluble in the iron and combines with the slag to form a protosilicate, returning reduced iron to the bath according to

$$FeO + Mn = Fe + MnO$$

Most good steels, however, are not totally free from entrained slag, and slag particles consisting of manganese and iron silicates are noted under the microscope. For the purpose of deoxidation, ferromanganese is usually added in such proportion that from 0.4 to 1.5% of manganese by weight is added. Spiegeleisen is used in bessemer practice to a greater extent than in openhearth work, because the alloy is there added for the purpose of recarburization to the desired carbon content, bessemer converting reducing the blown metal to traces of carbon, while openhearth melting runs the bath down to the required carbon content or a little below, so that higher manganese alloys are preferable in the latter.

Manganese neutralizes the effect of sulphur by forming manganese sulphide, MnS, which goes partly into the slag and remains partly in the metal. At the termination of a blow or heat, the sulphur present is in the form of ferrous sulphide. This compound, as microscopic work has shown, exists as films between the metallic grains, a condition which destroys the cohesion of grains and gives rise to a great weakness and brittleness of the metal at a forging heat, known as red-shortness. The manganese sulphide formed which remains in the metal is in the form of rounded inclusions which do not harm the steel to any appreciable extent.

Ferromanganese is used largely in the production of manganese steel. This is a high-alloy steel containing from 11 to 13% manganese and about 1.5 to 2% carbon. This steel is used for railroad and street-car rails on curves, jaws and wearing parts of rock-crushing machinery, railroad frogs and crossings, mine and other car wheels, burglar-proof safes, etc.

The problem of the most economical method of adding the required percentage of manganese to steel has existed ever since the discovery of the manufacture of steel. In the early days of the bessemer process, spiegeleisen containing from 6 to 20% manganese was universally employed. This alloy was melted in cupolas and tapped off when needed, to be run into the converter in the liquid condition. The great loss of manganese through volatilization was against this method, and when the higher percentage of ferromanganese was made and the quantity of alloy required was corespondingly reduced, the cupola was not practical for its melting. Various methods of melting in different furnaces have been tried. When cost is a minor factor, ferromanganese is melted in crucibles and added liquid, but this method is prohibitively costly for ordinary procedure. The standard method has been to break up the ferromanganese into lumps of fist size and add the alloy solid. In some cases the alloy is heated to a red heat before adding. It may be added in part to the bath and part to the ladle, or entirely in the ladle, which is standard practice in the United States.

High Manganese Losses Prevented by Electric Smelting

The solid addition of manganese gives rise to a loss of from 18 to 35% of the metal added. Until the advent of the electric furnace no suitable apparatus for dealing with this problem was available. In the few last years, however, a number of steel plants abroad have installed electric furnaces for melting ferromanganese so that a liquid addition may be made. The Rennerfelt furnace of about 600 lb. capacity has proved adaptable for the fusion of the alloy, and installations include those at the Hallstahammar Works, Sweden, and also 2.5-ton sizes at the Ljusne Works, Sweden. The loss of manganese by electric melting is practically nothing.

The manganese ore used in this country for the production of ferromanganese has been mainly secured from three principal sources, which are Russia, India and Brazil. For many years these three countries have outranked all other producing countries in the output of manganese ores. Both the Russian and Indian output suffered a falling off after the war started, but the Brazilian output has increased with leaps and bounds until its 1916 production is rated at 600,000 tons, as near as can be estimated from available figures. Brazil is the principal foreign source at present. Iron-manganese alloys have not been received in any quantity since the war started, with the result that a new domestic industry, that of ferromanganese production, has reared itself in this country in the past two years. Spiegeleisen has been made here for about 45 years from the manganiferous zinc residuum of New Jersey, but the ferromanganese output was limited to one large company which produced about one-quarter of the total consumption, and that for its own needs. Today a dozen blast furnaces are making ferromanganese and spiegeleisen, and a small tonnage is being produced by electrothermic methods.

Prices of ferromanganese prior to the war were around $45, tidewater, but owing to the war uncertainties they touched over $450 for spot metal in 1916. Spot spiegeleisen went over $100, furnace, during the same time. Prices have been driven high by unprecedented demand, but not so high as speculative dealings have desired to urge them.

British Dealings in Lead

The British Minister of Munitions has issued an order, under date Apr. 6, ordering that no person shall as from the date mentioned until further notice purchase, sell, offer to purchase or sell, or, except for the purpose of carrying out a contract in writing existing prior to such date for the sale or purchase of white lead, lead oxides, lead manufactures, lead alloys or lead compounds of any kind, or a contract in writing existing prior to Feb. 2, 1917, for the sale or purchase of any other kind of lead, enter into any transaction or negotiation in relation to the sale or purchase of lead situated outside the United Kingdom except under and in accordance with the terms of a license, issued under the authority of the Minister of Munitions.

This order was published in *Chemical Trade Journal and Chemical Engineer,* London, Apr. 14, 1917, and states that no person shall offer to purchase, purchase or take delivery of any lead situated in the United Kingdom except under and in accordance with the terms of a license issued under the authority of the Minister of Munitions, or offer to sell, sell, supply or deliver any such lead to any person other than the holder of such a license and in accordance with the terms thereof; provided that no such license shall be required in the case of any offer to sell or purchase, sale, purchase, or delivery of such lead: (a) For the purpose of a contract or order for the time being in existence certified to be within Classes A or B. (b) For the purpose of necessary repairs or renewals requiring immediate execution and involving the use of not exceeding 1 cwt. of lead and not exceeding 28 lb. of white lead, lead oxide or lead compound. No purchase or sale of lead situated in the United Kingdom, or offer to purchase or sell any such lead, shall in the case of any class of lead specified in the schedule hereto be at a price exceeding the price set opposite the same in the schedule. All persons shall within seven days from the first day in each month send in to the Director of Materials, Hotel Victoria, Northumberland Ave., London, W. C. 2, monthly returns of: (a) All lead held by them in stock or otherwise under their control on the last day of the preceding month, the lead actually in stock to be shown separately. (b) All lead purchased or sold by them for future delivery and not yet delivered on such last day. (c) All lead delivered to them during the preceding month. (d) All contracts or orders existing on the last day of, or entered into during, the preceding month requiring for their execution the use of lead for any purpose, specifying the amounts of lead required monthly for the purpose of such contracts or orders, and distinguishing between the amounts required for work certified to be within Classes A and B respectively in the said order of Mar. 8, 1917, and the amounts required for other purposes.

Notwithstanding the above, no return is required from any person whose total stock of lead in hand and on order for future delivery to him has not at any time during the preceding month exceeded 1 cwt. For the purpose of this order the expression lead shall mean pig lead whether virgin or remelted, sheet lead, lead pipe, and old and scrap lead, white lead whether dry, in oil or prepared for use, lead oxides, lead manufactures, lead alloys and lead compounds of every kind, or any of them. All applications for licenses to purchase or use lead shall be made to the Director of Materials, Hotel Victoria, Northumberland Ave., London, W. C. 2, and marked "Lead License." The order of the Minister of Munitions dated Feb. 2, 1917, relating to certain classes of lead is hereby canceled.

Pig Lead—Virgin pig lead, £29 per ton net ex ship, £30 per ton net ex store or ex refiners' works. Scrap lead or remelted scrap lead, £26 per ton net ex sellers' premises.

Manufactured Lead—Sheet lead, £39 10s. per ton; lead pipe, £40 per ton, delivered United Kingdom, less 2½% monthly account; the usual trade extras and allowances to apply. The rate of exchange between chemical houses and manufacturers of chemical sheet lead, for the old lead in pig-lead shape, to be £8 per ton net for sheet lead and £8 10s. per ton for lead pipe, the manufacturer paying cost of delivery of the old lead; the sheet lead or lead pipe to be delivered United Kingdom. The usual trade extras to apply.

Lead Compounds—Dry white lead, £46 per ton, less 5% monthly account, delivered United Kingdom. The usual trade extras and allowances to apply. White lead in oil, £53 per ton, less 5% monthly account for deliveries in packages of 5 cwt. and over; £55 per ton, less 5% monthly account for lots of less than 5 cwt. White lead in packages less than 5 cwt. to be charged at the customary trade extra for packing. These prices for white lead in oil are based on a price of £50 per ton at the spot price for raw linseed oil in barrels. If the average daily spot price of raw linseed oil during the preceding month rises or falls by multiples of £6, then the above maximum price of white lead in oil shall rise or fall by 10s. per ton for every £6 per ton rise or fall in the price of linseed oil.

Red Lead and Litharge—£42 per ton, less 2½% monthly account, in 5 cwt. casks delivered United Kingdom. The usual trade extras and allowances to apply.

Licenses to purchase and take delivery of lead situated in the United Kingdom will usually be granted by the Minister of Munitions under this order for necessary repairs and renewals in the ordinary course of trade, and will also be granted for any other purposes which may be approved by the Minister of Munitions, including manufacture for the purposes of export trade. Every applicant for a license must state the amount of lead required by him per month and the use to which it will be put.

Minerals of Military Importance

WASHINGTON CORRESPONDENCE

Minerals of military importance are discussed in a report being submitted to the National Research Council by Van. H. Manning, director of the Bureau of Mines. Iron, copper, lead and zinc are not taken up in this report, since the production of these metals is carried on in a routine manner and no problems other than those relating to labor supply and transportation are involved. Chief emphasis is placed upon nitrates, platinum, mercury, iron pyrite, sulphur and the alloy metals.

Commenting on the nitrate situation, the opinion is expressed that there is little prospect of natural deposits of nitrate being found. "The only possibility," says the

report, "of an independent supply seems to rest in the fixation of nitrogen from the air or of the oxidation of ammonia, obtained as a byproduct from gas works and byproduct coke ovens, to nitric acid."

With regard to sulphuric acid, the report points out the need for the encouragement of acid production by smelters. It is also suggested that the exposed sulphur deposits of the country be protected. Research leading to the utilization of pyrite deposits and a more complete inventory of sulphur and pyrite occurrence in the United States are recommended.

Possibilities of expanding the domestic iron-pyrite production are pointed out. It is suggested that a supply of pyrite could be obtained in connection with coal mining in Pennsylvania, Indiana, Ohio and Illinois. A total of 956,000 tons of sulphuric acid was produced as a byproduct from smeltery fumes. "Tremendous quantities of sulphuric acid," declares the report, "could be manufactured in connection with the smelteries in Montana, California, Utah and Arizona. Only a small beginning has been made. The chief problem is that of a profitable market in times of peace. The manufacture of explosives, and particularly the prospects of developing the Western phosphate deposits, may increase the demand."

A government reserve of platinum is justifiable by the military importance of the metal, it is stated. In an emergency, sufficient platinum for the military needs of the United States might be obtained from jewelry, it is asserted. On this subject, the report continues, "At the present time the only serious problem would be a supply of platinum for the manufacture of sulphuric acid and for possible use in the oxidation of ammonia to nitric acid if that method is developed to supply a possible deficiency in nitrate of soda. In the present expanded condition of the industry to supply munitions to Europe, the problem is considerably lessened."

"The problem in mercury," continues the report, "is to improve the present treatment and metallurgy, to reduce waste and to render available considerable quantities of low-grade ore and material in old dumps at present unworkable. These improvements might guarantee a greater supply for the future than can be depended on now. This means a prevention of losses by absorption in the furnace and in escaping fumes, and either concentration of low-grade ore or direct smelting. Considering the present importance of mercury as fulminate, a study of possible substitutes which will decrease the amount of mercury required is of primary importance." This also applies to other uses as well.

The lack of domestic manganese is regarded by the Bureau of Mines as fully as serious a problem as is that of nitrate or potash. It is suggested that a reserve supply be accumulated, that low-grade sources of the material be expanded, that partial substitutes be developed and that losses in preparation and use be reduced. The zinc residium of New Jersey, the silver-lead ores of Colorado and the iron ores of Minnesota offer the best possibilities of large expansion. Special pains are taken in several places to point out the great need for research in the whole problem of metallic alloys. A saving of 30% of present losses of tungsten can be made by improved methods of milling and ore treatment, the report says. Molybdenum and uranium are possible substitutes for tungsten as a steel alloy.

To protect itself absolutely from its deficiency in nickel, the United States would have to accumulate a reserve supply of 40,000,000 lb. With a supply close at hand in Canada, the situation is not so bad as otherwise would be the case. The United States deposits are of low grade, and no commercially successful process for their concentration and extraction is known. Research should be carried on along this line, the report advises. The increasing importance of cobalt is pointed out. Experiments in the separation of cobalt from other metals, with which it occurs, should be carried on, says the report. The production of molybdenum in the United States probably can be increased considerably. It is pointed out that it is a very difficult alloy to handle and its use consequently is increasing very slowly.

The recovery of vanadium, which now is being lost in the treating of certain lead ores in the West, is recommended. Since the United States has the largest known deposits of uranium in the world, attention is called to the fact that Germany is using this metal probably in the linings of large-caliber guns. As the United States has not an adequate domestic supply of antimony, the study of calcium, barium, lead and other substitutes is recommended.

With regard to prospecting for potash deposits in the United States, the report says: "Exploration would be costly, but might result in finding suitable new deposits. The probability is sufficiently great to warrant the employment of geologists to make a careful study of oil, gas and salt wells, which are being drilled in likely localities, and even to some extent in the drilling of prospect bore holes. The Geological Survey already is doing some work along this line. It should be extended." This would be likely to give results.

Chances for developing any considerable tin supply in the United States are admitted to be few. It is pointed out that the smelting of Bolivian tin ores in this country has improved the situation greatly. Research as to a greater recovery of tin from scrap and junk is recommended. Substitutes for graphite should be investigated, in the opinion of Director Manning. It is pointed out that there is not sufficient flake graphite in the United States to supply the necessary amount for crucibles. Discovery of a vast deposit of magnesite in the State of Washington has relieved the United States of any danger of a shortage of this mineral in case of an emergency.

Bolivian Tin Ore Shipments

According to a report on Bolivian tin ore statistics, issued by E. A. Witt's successor, London, the shipments of Bolivian tin ore to the United Kingdom in 1915 amounted to 19,934 tons, and in the same period to America, 1129 tons. In 1916 the shipments amounted to 16,233 tons to the United Kingdom, and 4811 tons to the United States. For the first quarter of 1917 the West Coast shipments show a falling off of nearly 1100 tons, of which over 800 tons are a decrease in shipments to America. The latter features, however, should only be temporary, as it is understood that there could be an early increase in the smelting capacity at Perth Amboy. A Bolivian report indicates that the present production is small. Indications are against an increase in supply from Bolivia during this year.

Enemy Supplies of Metals and Ores

Prediction in this country early in the war was so general that the Central Empires would be unable to continue the struggle for any prolonged period, owing to their deprivation of indispensable mineral products through the closing of the seas, that we are tempted to forget, says the *Mining Journal,* in noting the successful struggle which German engineers and chemists have made to meet this growing handicap, that with every fresh period of the war the difficulty of providing indispensable supplies increases, so that by this time they must be a veritable nightmare, which the entry of the United States into the combat will further intensify. Not unnaturally, perhaps, the French technical press has devoted more attention to the German exigencies and to their efforts to dispose of them than has been the case here. A recent issue of *Metaux et Alliage* contains a number of estimates that are of great interest even for the public that is outside the mineral industry, and these are supplemented by figures available to us from other sources. The following are some of the chief items that figure in a computation of the enemy's needs:

Copper—It is esimated that the requirements for artillery alone are not less than 16,000 metric tons a month. Serbia and Turkey are estimated to be capable of producing 60,000 metric tons a year, and Germany herself 30,000, or 7500 per month. The material requisitioned at home and in the invaded territories has been estimated at 1,000,000 metric tons, and a large saving has been possible by substituting other minerals and alloys.

Scarcity of Manganese

Manganese—The want of manganese is being severely felt, and orders have been issued for all known deposits to be developed. Previous to the war the output of low-grade ores was 92,474 metric tons from Prussia, most of it from the Bonn district. The only deposit producing what is commercially considered manganese was that at Giessen, and the output was only a few hundred tons a year. In Austria-Hungary the production in 1912 was 12,471 metric tons of low-grade stuff, while from Bosnia and Herzegovina there was an output of 4650 metric tons of somewhat higher-grade ore. A small production of manganese has also been obtained from mines in Asia Minor and Macedonia. There was also a considerable output of manganiferous iron ore. When, however, it is remembered that the net import into Germany alone in the year previous to the war was 671,000 metric tons, the inadequacy of these native deposits will be realized.

Chrome—The net import of chrome ore in 1913 was approximately 23,000 metric tons. Considerable supplies are, of course, available from Asia Minor, and if the labor and transport were available more than the 1913 imports could be easily obtained. Production from Turkey in Asia has, however, been a declining quantity for years past. The last figures that we have are as far back as 1907, when the amount exported is given as 28,860 metric tons. In addition, there are deposits in Styria and Silesia, from which, perhaps, 5000 or 10,000 metric tons might be obtained. The requirements of the Central Empires are estimated by our contemporary at as high as 47,000 metric tons, or double the imports in 1913. If the consumption has increased to this extent, of course there may be some deficiency, and this is perhaps more likely, as the Germans are known to have been employing chrome as a substitute for tungsten.

Tungsten—The net import of tungsten ores in 1913 was 4500 metric tons, and by this time the import of all foreign ores should be stopped. The native production of wolfram ores in 1912 was 101 metric tons, at about which figure it had been pretty steady for some time; while in Austria, for the same year, the output was 66 metric tons. No doubt, irrespective of price, these figures would be improved upon, but we cannot suppose that the supply can be much over 500 metric tons. The price of wolfram in Germany is said to have risen to 50 marks per kilo.

Nickel—The shortage of nickel is widely appreciated, and it is reported that the Germans have had to fall back on manganese steel. Some supply has no doubt been obtained from Norway, but whether this is today available is another matter. The import in 1913 amounted to 3315 metric tons, about half of which was reëxported. The normal requirement, therefore, was about 1700 metric tons. The production from Christiansand works in 1912 was 390 metric tons of metal, but it was not all from native ores. Now that the occasional supplies by submarine from the United States are cut off, it is quite likely that Germany is deprived of any fresh supply of this metal.

Molybdenum—The great activity that has been manifested in Scandinavia in regard to the exploitation of molybdenum is certainly connected with German enterprise, and the impression among those familiar with the industry is that supplies have been reaching the enemy in the past from these sources, though it is most difficult to trace them, and in no case can their magnitude be determined. The Norwegian output of molybdenite increased very largely in 1915, and fresh concentrating plants are either in operation or on order. The output of molybdenite, however, is too small to have much effect, especially as it would be in demand in Germany both for high-speed steel and for armor plate.

Methods of Obtaining Sulphur

Sulphur—Before the war Germany imported 1,023,952 metric tons of pyrites for the manufacture of sulphuric acid, of which Spain and Portugal contributed 906,420 metric tons. With the production from Silesia of about 300,000 metric tons she normally controlled a supply of about 1,300,000 metric tons. Since the war she has obtained supplies of blende from Poland and pyrites from Norway, Turkey and Greece. The most important of these sources of supply was Norway, which in 1913 supplied about 50,000 metric tons. The Norwegian production is now understood to be no longer available to Germany, which now, therefore, finds herself forced to obtain sulphuric acid from other material than pyrites. It is claimed that by the agency of the electric furnace sulphuric acid is being obtained from gypsum, sulphate of lime and sulphate of magnesia. Germany was also a large exporter of sulphate of barites, the exports of which in 1913 amounted to 150,000 metric tons. Sulphate of ammonia is also manufactured from the sulphur contained in lighting gas and from coke-furnace gas by the Burkheiser and Feld processes. Estimates as to how much sulphuric acid can be obtained by these expedients are obviously impossible, but it is clear that they must fall very far short of what is needed.

Substitutes—Remarkable efforts have been made in Germany to meet inevitable deficiencies by substitutes. Pure zinc has been used to replace copper to a large extent as an electrical conductor, in which respect also alu-

minum appears to be largely utilized. It is generally believed that aluminum is now being produced from clay, at least under the economic conditions just now obtaining in Germany. At any rate the metal appears to be less scarce than it was, and it is employed as a substitute for copper for electrical purposes. Iron, however, is the mainstay of the situation. Iron or steel cores are used in cables with zinc wires, thus combining the conductivity of zinc and the mechanical strength of the iron, and it is extensively employed for the transmission of current on railways, tramways and the like. Antimonial lead has been replaced by an alloy of lead sodium or lead calcium, and nickeling by cobalting.

When every allowance, however, is made for the ingenuity and skill with which difficulties have been met, it is obvious that there is necessarily a great waste of effort and diminution of production through the forced adoption of substitutes, where such can be obtained. While the plants for the production of nitric acid from the air appear to have solved one serious difficulty, that of sulphuric acid will become constantly more pressing. One of the chief effects of the recent siding of neutral powers with the Entente will be felt most immediately in the increasing difficulty of obtaining supplies of ore and metal through neutral sources. In the recent fighting in France the enemy's artillery appears to have been markedly inferior in volume to the fire of our own, and though there may have been accidental circumstances to account for this, we cannot dismiss the probability that lack of raw materials is beginning to tell on the supply of munitions

Electric Hoists on the Rand

Some of the principal features of the largest electric hoists installed at Rand mines are given in the accompanying table, published by the *South African Mining Journal*.

The table shows the name of the mine, the manufacturer of the hoist, the type of control, the motor and their horsepower, hoisting capacity, with sundry details regarding the load, speed of hoisting and of the motors.

Chino Copper Co.

The report of the Chino Copper Co. for the first quarter of 1917 shows a production of 19,225,111 lb. of copper—6,452,154 lb. in January, 6,572,106 lb. in February and 6,200,851 lb. in March. The total amount of ore treated for the period was 851,500 tons, an average of 9461 tons per day. Average copper content was 1.60%, and average production per ton was 22.58 lb. Of concentrates 61,238 dry tons averaging 15.7% copper was produced.

In addition to the copper produced by milling 1464 lb. came from shipping ore and 14,002 lb. from precipitating plants at the mine. Cost per pound of net copper produced was 10.12c. after allowing for smelter deductions and crediting all miscellaneous income, the higher cost being due to higher rates and new kinds of taxes. The amount set aside for reserve for tax payments was $295,762.

The net profits and miscellaneous income total $2,992,071 and dividends paid, $2,174,950, leaving a net surplus for the quarter of $817,121. Earnings are based on 26.38c. per lb. for copper.

Oregon Mining Law

By A. L. H. Street*

One who locates a mining claim on unsold public land of the State of Oregon acquires a mere temporary possessory right, according to a decision of the supreme court of the state in the case of Grand Prize Hydraulic Mines vs. Boswell, 162 Pacific Reporter, 1063. This right is forfeited by his failure to purchase or lease the land under the established regulations of the state land board.

Other legal points decided in the same case are, that an assignee of a mining claim takes no stronger rights than his assignor had, unless he be an innocent purchaser for value; and that a mining claim is real property within the Oregon statute which invalidates contracts for sale of real estate unless the agreements be reduced to writing.

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DATA ON PRINCIPAL ELECTRIC HOISTS AT RAND MINES

Mine	Name of Supplier	Type of Winder	Maximum Depth of Wind	Tons of Rock per Wind	No. of Complete Trips per Hour	Motor Data			
						Number of Motors	Horsepower Continuous Rating	Voltage	R.P.M.
Crown Mines, Ltd.	Electrical — G.E.C. of America (S.F. Gen. Elec. Co.) Mechanical—Fraser & Chalmers	Ward-Leonard Cylindro-conical drums	3,540 ft. vertical	8	45	2	2,000 hp. each motor	1,000 v. across two motors in series	53.5
Crown Mines, Ltd.	Motor-generators—Siemens Winder motors—A.E.G. Mechanical—Fraser & Chalmers	2 Ward-Leonard winders Cylindro-conical drums	2,260 ft. vertical	8	45	4 (2 on each winder)	1,420 hp. each motor	1,000 v. across two motors in series	53.5
E.R.P.M. Hercules Shaft	British Westinghouse Electric and Mfg. Co., Ltd.	Ward-Leonard Cylindro-conical drums	4,500 ft. vertical	8	20	2	750 hp. each motor	1,000 v. across two motors in series	33.3
Village Deep, Ltd. and City Deep, Ltd. (6 similar equipments)	The British Westinghouse Electric and Mfg. Co., Ltd.	Three-phase motors direct-coupled two-cylindrical drum hoists. 4 Whiting hoists)	3,600 ft. vertical	5	32	1	1,600 hp.	2,000 v. three-phase 50 cycles	100
Bantjes Consolidated Mines, Ltd.	Siemens, Ltd.	Three-phase motor geared to cylindrical drums	4,000 ft. incline	5	23	1	1,470 hp.	2,000 v. three-phase 50 cycles	250
Consolidated Langlaagte G.M. Co., Ltd., (2 similar equipments)	Siemens, Ltd.	Ward-Leonard	Compound shaft 1,230 ft. vertical and bend 3,000 ft. incline	5	23	1	1,290 hp.	500 v. direct current across winding motor	80
New Modderfontein G. M. Co., Ltd.	A.E.G. Electrical Co. of S.A., Ltd.	Three-phase motor direct-coupled to cylindrical drums	2,000 ft.	3	45	1	1,200 hp.	2,000 v. three-phase 50 cycles	....

Flotation Litigation at Butte

The suit brought by Minerals Separation, Ltd., against the Butte & Superior Mining Co., was concluded on May 17. This case was before Judge Bourquin in the U. S. District Court at Butte, Mont. The principal question was whether the present operations of the Butte & Superior Mining Co. infringed the patent in question. In these late operations, slightly over 1% of oil upon the dry weight of ore treated, is employed, and the procedure is in all respects the same as the operations carried on for somewhat more than five years preceding the decision of the Supreme Court of the United States, of Dec. 11 last, except for the increase in the amount of oil used.

Counsel for the defendant contended that the Supreme Court has limited the patent to the use of oil in the proportion of a fraction of 1% on the ore, and showed at length that froth-flotation operations by the Utah Copper Co., at its Arthur and Magna plant, by the Chino Copper Co., and by the Ray Consolidated Copper Co., with the smaller amount of oil before the Supreme Court decision and the larger amount of oil after the Supreme Court decision, were being carried on and argued that since substantially the same results could be obtained with more than 1% of oil as can be obtained with less than 1%, the Supreme Court had been mistaken in its opinion and the patent was void for lack of invention.

The representatives of Minerals Separation submitted evidence agreeing with the defendant that the operations with slightly more than 1% of oil were substantially the same as those with a fraction of 1% and therefore were infringements of the patent. Minerals Separation contends that the Supreme Court has not imposed the limitation as it is interpreted by Butte & Superior, but points out that the decision instead of being a limiting one, is essentially broadening.

Argument for Minerals Separation

In his argument, counsel for the plaintiff reviewed the Supreme Court decision and argued that the intent of that verdict was to secure to Minerals Separation entire rights covering the process where the results secured were the same as the results obtained by the use of a fraction of 1% of oil. Evidence was given to the effect that the petroleum oils most largely used in the effort to avoid infringements were wholly inert in the froth-producing process, while the oils that were active in the process, pine oils, creosote, etc., were used in proportions far below 1%, and in fact were used in critical proportions such as are recommended in the patent in suit.

Relative to claims 9, 10 and 11 of the patent, which were for the use of a small quantity of oil and therefore did not contain the limitation of the other claims, the Supreme Court had held these claims to be invalid, stating that the patent must be confined to "the results obtained" by the use of a fraction of 1% of oil, whereas these claims as they stood might be interpreted to cover oil flotation depending upon the buoyancy of the oil to carry and float the mineral particles. The plaintiff filed a disclaimer limiting the claims to processes wherein the results obtained were substantially the same as those obtained with a fraction of 1% of oil. The validity of this disclaimer was contested by the defendant at the commencement of the Butte trial, and after full argument, Judge Bourquin held it to be valid, and to have validated claims 9, 10 and 11. Thereafter the pleadings were amended, charging infringement of these claims as validated additionally to an infringement of the other claims which the Supreme Court had held to be valid and to charge the infringement of all of these claims by the recent operations of the defendant.

It was argued by Minerals Separation that these froths formed by the use of more than 2% of oil are in fact oily magmas, or pastes, inflated with air bubbles, and that they are not the real froth that is formed by the Minerals Separation process. It was argued that all of the oil, beyond a certain small proportion within the critical amount allowed, in the test, was merely waste, and of no effect whatever so far as forming the mineral-bearing, efficient froth, is concerned. As a matter of fact, it was argued, a very large proportion of this oil floats off in the first cell of the flotation machine, and an additional large percentage is lost in the tailings discharged, so that the actual amount of oil left to work in the pulp is far below the critical proportion of 1%.

Profits of the Process

It was asserted during the argument that the profits made by the Butte & Superior Mining Co. from flotation during the past three years have exceeded $18,000,000 as appeared by its own sworn statement while in court, and it was estimated that the profit from flotation of the allied companies engaged in and helping in the defense exceeded $100,000,000. During the trial a new suit was commenced against Butte & Superior Mining Co. for infringement of the patent for soluble frothing agents, U. S. No. 962,678, of June 28, 1910. This patent was also involved in a suit against the Miami Copper Co. and was held to be valid and infringed.

To sum up the contentions of the two parties to this suit, it may be said that Butte & Superior Mining Co. argues that there is no difference in basic theory between the results obtained with less than 1% of oil and those obtained with more than 1% of oil in operating the process. Minerals Separation agrees that there is no difference in the results obtained, but that the results are due entirely to the small critical proportion of oil used, and that the larger quantities of oil have no effect whatever, but are run to waste. In this connection Minerals Separation points out that the great bulk of the oil used is made up a material as innocuous and cheap as it is possible to obtain, which oils would have no effect whatever if used by themselves. They are, in fact, used in connection with minute quantities of frothing oils, and these, Minerals Separation contends, are what produce the particular efficient results obtained through the process. In other words, Minerals Separation contends that large quantities of oil are simply waste, that small quantities of oil are all that is necessary to secure their peculiar results, when the proper kind of oil is used, and that the large quantities of oil not only involve more expense for oils themselves, but actually impede the efficiency of the process and make the percentage recoveries materially under those secured when following the process as they advise. They point for corroboration of this fact to the results secured by the Butte & Superior Mining Co., according to their sworn reports made to the Court, before and after the decision of the Supreme Court.

Butte and Superior contends, however, that a patent on the use of a critical amount of oil cannot be valid, since the process is no more than a commercial development of methods that were known before.

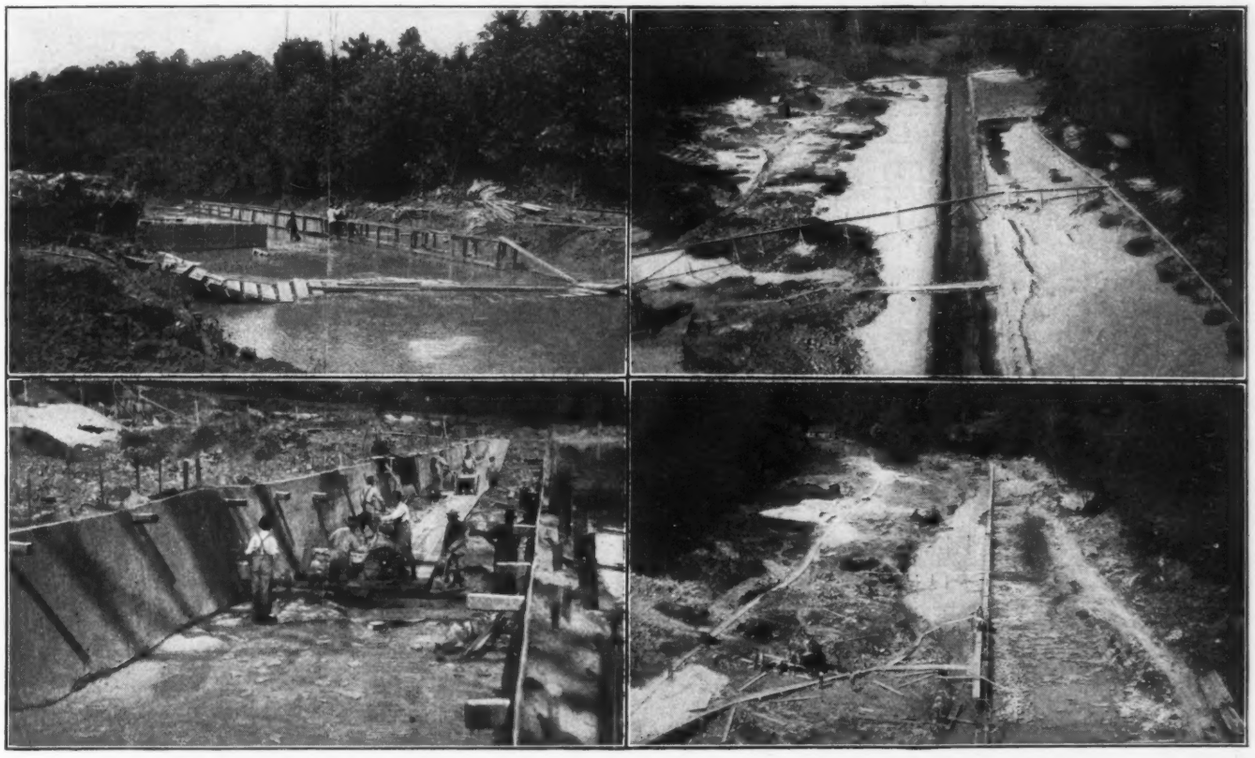
Concreting a Creek Channel

By C. W. Wardle*

SYNOPSIS—To reduce the flow of water into the American Zinc Co.'s mine at Mascot, Tenn., the bottom of a creek channel was concreted. The amount of pumping necessary in the mine decreased from 2000 gal. to 100 gal. per min. since completion of the work.

The American Zinc Co. of Tennessee, Mascot, Tenn. is nearing the completion of an undertaking intended to solve a difficult water problem. The chief object of this article is a description of the methods employed in concreting the channel of a fair-sized creek. As a prelude, the conditions necessitating the undertaking will probably be of interest. Fig. 1 shows the relative positions of the mine workings and the creek. The main level of the mine is approximately 140 ft. below the bed of the creek, but the underground workings to the west of the creek are considerably higher. As the mine workings have advanced toward the creek, the volume of water in the mine has greatly increased. In January, 1916, the mine was drowned as a result of a tide in the creek. The water finds its way into the mine through crevices which open into the creek. The crevices conform in a general way with the strike of the formation and are probably the result of faulting. The orebody is a breccia, but the disturbances causing the crevices, if such was the cause, was apparently subsequent to the brecciation. The crevices vary in width from a few inches to several feet. They are confined to an area a few hundred feet transversely, but have been encountered the full length of the mine workings. Their dip is in the neighborhood of 60° to the southeast, while that of the formation seldom exceeds 25° in the same direction. When encountered, they are usually filled to the walls with mud and boulders.

The creek empties into Holston River a half-mile from the point where it passes the mine, and high stages in the river back the creek up considerably past this point. The heavy rains in December, 1915, brought on a flood stage. The pump capacity in the mine was insufficient to handle the greatly increased volume of water, and the mine was drowned. While the fight was on to save the mine, a hole which was admitting a large volume of water was discovered in the edge of the creek. A cofferdam was built around it and the opening concreted at the solid, but even with this shut-off the mine was lost.



CONCRETING CREEK CHANNEL, MASCOT, TENN., TO REDUCE SEEPAGE INTO MINE

During last summer an appropriation was made to concrete the channel of the creek and I was placed in charge of the work. It will be noticed from the contour map, Fig. 2, that there was no chance to divert the water while the work was being done. The plan decided on was to build a concrete wall down the center of the creek and divert the water to one side while the work was being done on the opposite, and vice versa. The building of the center wall was the problem of the undertaking, but a simple scheme proved satisfactory. Jackhamer holes were put down along the line of the center of the wall and at distances of 10 ft. apart. These were drilled to a depth of 16 in. and wedge bolts put in the holes and securely fastened. Difficulty was experienced in many

*Mining engineer, Mascot, Tenn.

of the holes, because of the sediment on the bed of the creek which filled up the hole immediately when the drill bit was withdrawn. To remedy this, a double box was made, as shown. This was placed over the location of the hole to be drilled and the space between the boxes filled with mill slimes. The water was then bailed out, the hole drilled and the bolt set. The doors of the outer box were then opened, which facilitated unloading the sand, and the box was removed to the next location. The wedge bolts were made of 1-in. round iron. They were threaded down 14 in., the split on the lower end was 5 in. and the wedge was 5 in. The caps were made of 4 x 4-in. pine timber, 54 in. long and with a hole in the middle for the bolt. These were held at the proper elevation by means of a nut above and below. The legs were made of 4 x 4's also, and were held in place at the bottom by means of a wire fitted at the top and slipped down. The bents were connected with 2 x 4's along the top. These served as stulls for the sheeting. For sheeting, 1-in. tongue-and-groove flooring was used. This was placed edgewise and fitted to the bottom, a 2 x 12 was nailed on the outside of the legs and the space between that and the sheeting was packed with bags of clay, straw, etc., making the form water-tight. Drawings of different views of the form are shown in Figs. 4, 5 and 6. The form thus constructed is self-sustaining; that is, no outside bracing is necessary—a feature which is a great advantage. The bottom inside the form was cleaned of all sediment. The concrete was poured in sections of three bents, beginning at the upstream end of the wall. The formwork was kept just ahead of the concreting, so that little could be destroyed in case of high water. The runways were made along the side of the form. In order to avoid bracing, 3 x 10's were used for runways and were joined at the bents. A few of the sections were pumped out before pouring the concrete, but this was found unnecessary and was discontinued. A sheet-iron funnel was made and the concrete poured in this to prevent the cement separating before it reached the bottom. When the wall was completed, the water was diverted to the east side of the wall by means of dams at the ends. The inclosed body of water drained out through crevices. The crevices were securely concreted up and the water diverted to this side. Another wall was built parallel to the first. The same form construction was used in the second wall as in the first. The walls were 21 ft. center to center. The floor of the creek between the walls was cleaned and leveled up and a concrete pad put on it. The pad was reinforced with No. 7 triangle mesh wire. Wing walls were built at each end and the space behind the walls was filled with slimes.

The money spent for this work has proved a good investment. The water to be pumped from the mine has decreased from near 2000 gal. to about 100 gal. per minute. The expenditure has cut off a continual expense and thus reduced operating costs.

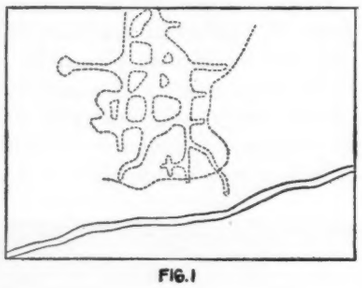


FIG. 1

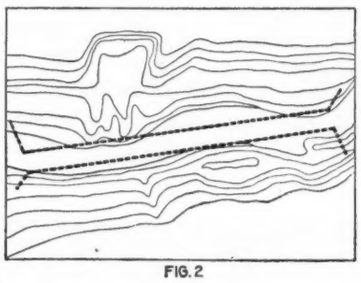


FIG. 2

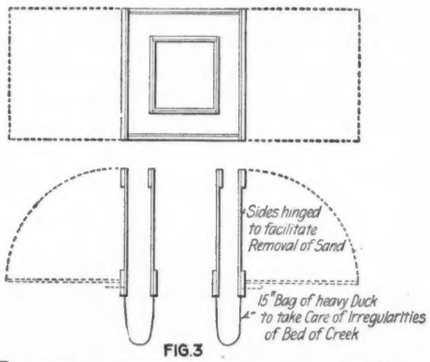


FIG. 3

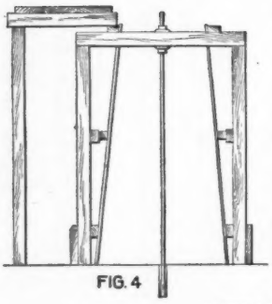


FIG. 4

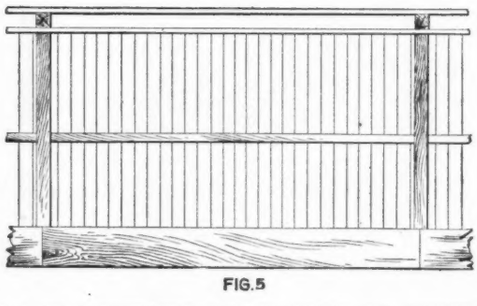


FIG. 5

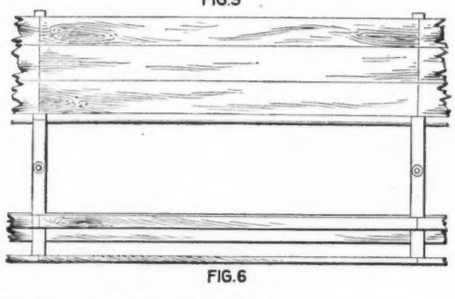


FIG. 6

DETAILS OF CONCRETE FORMS USED IN CONCRETING A CREEK CHANNEL

Bauxite Production in 1916

The production of bauxite, the ore of aluminum, in 1916, was 425,359 long tons, an increase of 43% over 1915. This is a notable increase for the whole United States, but the most striking figures are those for Georgia and Alabama. In 1915 the production of bauxite in these two states was 25,008 long tons. The output was increased to 46,410 long tons in 1916, a gain of 86%. A large part of this increase is due to the operation of new and old mines in central Georgia, notably in Wilkinson, Meriwether and Sumter counties.

The production in Arkansas and Tennessee was increased from 272,033 long tons, in 1915, to 378,949 long tons in 1916, a gain of 39%. This increase can be attributed to the development of the Arkansas deposits.

There has been much activity in Georgia and Alabama, where many newly found deposits were brought nearly to a producing stage in 1916. Advices received by the United States Geological Survey indicate that a number of old deposits in these states will be reopened, owing to the increased value of the ore and to the fact that it is used by many new enterprises.

William A. Farish

William A. Farish died in Los Angeles, May 4, while he was returning from a mining trip into Arizona.

Colonel Farish, as he was known commonly, was born in Macon, Tenn., in 1843, and accompanied his mother, brothers and sisters to California in 1852, to which point his father had preceded the family in 1849, and had there become one of the pioneer wool merchants of the state. William attended school in San Francisco and Marysville, and afterward went to the Sierra Buttes mine, near Downieville, Calif., where he obtained his practical mining education. For a number of years he managed that property with great success in the interest of the Reis Brothers, who were then prominent merchants of San Francisco.

In 1869 he was one of the owners of the Monumental mine in Sierra County, Calif., and took from it the largest gold nugget that had been found in California to that time. Its weight was 103lb. and it was sold to R. B. Woodward, proprietor of the then famous Woodward's Gardens of San Francisco, for $25,000. Woodward exhibited it for some time in the Museum at the Gardens.

In the early 70's Mr. Farish took charge of the Black Bear mine in Klamath County, Calif., owned by John Daggett, who was then Governor of California, and under his management made its record production.

In 1875 the Black Hills district of Dakota, which was then located in the wild and unsettled Indian country, was beginning to attract attention. The first experts who visited the section were not favorably impressed, regarding the values as too low to be profitable. A year later the late Senator George Hearst became interested and sent Farish to examine the mine. In making his report he asked Senator Hearst if he was ready to spend $500,000 before taking out a penny from the mines. Hearst replied he was, and Farish advised the purchase of the celebrated Homestake mine. With other associates other properties were taken up, which were finally consolidated into the famous Homestake Consolidated Mining Co. Perhaps no report he made has had a wider influence in our country than this report on the Black Hills, for the purchase made by Senator Hearst increased his wealth and laid a permanent foundation for the great fortune he left when he died.

The fall of 1878 found Farish in Leadville, the riches of which were then beginning to attract attention in the mining and financial world. He became interested in mines on Fryer and Carbonate Hills, some of which afterwards became world famous as producers.

When Cripple Creek, Colorado, was first discovered it will be remembered that the experts who visited it decided that the ore deposits were superficial. Farish was sent to examine the deposit, and reported to his principals, who were railroad men, that even if the deposits were superficial there was enough ore exposed to justify the building of a railroad, but that in his opinion the ores would extend in depth. The result of this report was the building of the first railroad—the Colorado Midland—into Cripple Creek.

In 1882 he was in Arizona and New Mexico in the interest of a Scotch Syndicate, which upon his report purchased the Longfellow and Metcalf mines. The company that was incorporated is known as the Clifton Copper Mining Co., and its long record of success was an endorsement of his opinion of the district, which has since become one of the best-known of the southwestern copper-producing sections. About the same time he acquired the Carlisle mine in Grant County, N. M., which he developed into a paying proposition for the late N. K. Fairbanks, of Chicago, and E. B. Gage, of Arizona. When Tombstone, Ariz., attracted attention he went there and acquired the Head Center mine and other interests, which were consolidated into the Grand Central Mining Co.

During his later years he has been interested in mining properties in Arizona and Nevada, and at the time of his death had extensive interests in Utah.

His genial personality and kindly disposition made him a host of friends throughout the mining sections of the West, as well as through the East. A widow, two married sons and two married daughters survive him. His brother, John B. Farish, is also well known in mining circles.

Foreign Trade in Lead and Zinc

Imports of lead and zinc during March, 1917, and the first three months of the year are reported by the Department of Commerce as follows:

Articles and Countries	March Contents, Lb.	Jan.-Feb.-Mar. Contents, Lb.
Lead Ore:		
France	64,692	64,692
Canada	3,057,064	6,396,741
Colombia	1,781	1,781
England	.....	182
Salvador	428	1,120
Mexico	2,197,645	6,051,604
Chile	.....	51,895
Peru	4,785	38,549
German Africa	.....	1,747,200
	5,326,395	14,353,764
Lead—Base Bullion and Bullion:		
Canada	.....	583,848
Mexico	6,870,205	9,613,023
Peru	.....	24,850
	6,870,205	10,221,721
Lead—Pigs, Bars and Old:		
France	69,710	89,086
Panama	8,453	19,349
Barbados	.....	2,000
Chile	.....	8,769
Colombia	1,054	2,894
Haiti	37,052	37,053
Mexico	.....	661,328
Canada	.....	184,591
	116,269	1,005,070

The actual tonnage of zinc ore imported in March amounted to 27,721 tons. The countries of origin and the metal contents were as follows:

Countries:	March Contents, Lb.	Jan.-Feb.-Mar. Contents, Lb.
Canada	665,000	2,604,000
Australia	6,650,000	12,484,280
Mexico	13,631,418	29,409,331
Spain	.....	3,163,560
French Africa	.....	1,245,000
	20,946,418	48,906,171
Zinc in Blocks, Pigs, etc.:		
Costa Rica	3,611	4,825
Panama	6,998	11,347
Cuba	68,111	124,764
Colombia	.....	3,000
Mexico	3,308	3,308
Brazil	4,345	4,345
Canada	.....	50
Guatemala	.....	888
England	.....	600
	86,373	153,127

Imports of zinc dust amounted to 67,287 lb. in March, 1917, and exports were 8800 lb.

Exports of lead and zinc were as follows (in pounds):

	March	Jan.-Feb.-Mar.
Lead pigs, bars, etc., produced from domestic ore	7,488,872	29,939,795
Lead, pigs, bars, etc., produced from foreign ore	1,671,469	3,219,729
Zinc, pigs, etc., produced from domestic ore	32,995,927	92,763,130
Zinc, pigs, etc., produced from foreign ore	16,460,533	31,481,623
Zinc rolled in sheets, strips, etc.	1,819,556	3,856,362

May Mining Dividends

Dividends paid in May, 1917, by 31 United States mining and metallurgical companies making public returns amount to $11,327,547, as compared with $11,038,170 paid by 34 companies in May, 1916. It is worthy of note that there was this increase over the corresponding month of last years in spite of the fact that Inspiration paid in May, 1916, but its payment this year came in April; also New Jersey Zinc paid an extra of $5 last May, but only its regular quarterly dividend in 1917. Holding companies paid $48,139, as compared with $372,139 in 1916. Canadian and Mexican companies paid $2,011,745 in May, 1917, and $1,644,627 in May, 1916.

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Am. Zinc, Lead & Sm.	U. S.	$1.00	$193,120
Am. Zinc, Lead & Sm., pfd.	U. S.	1.50	144,840
Anaconda, c	Mont.	2.00	4,662,500
Arizona Cop., pfd	Ariz.	.....	53,840
Boss, g. s. p	Nev.	.02	8,170
Bunker Hill & Sullivan, l. s.	Ida.	.50	163,500
Butte Bullwhacker, c	Mont.	.01½	15,000
Caledonia, l. s.	Ida.	.03	78,150
Chief Con., c	Utah	.10	88,302
Cresson, g. s	Colo.	.10	122,000
Douglas Min	Ida.	.01	8,525
Eagle & Blue Bell, l.	Utah	.10	89,315
Golden Cycle, g.	Colo.	.03	45,000
Grand Central	Utah	.04	20,000
Hecla, l. s.	Ida.	.15	150,000
Homestake, g.	S. D.	.65	163,254
Internat. Nickel, pfd.	U. S.-Can.	1.50	133,689
Mammoth, g. s. c.	Utah	.30	120,000
Mass. Con., c.	Mich.	1.00	97,317
Miami, c	Ariz.	2.50	1,867,785
Nat. Zinc and Lead, l. z.	Mo.	.02	10,000
Nevada Wonder, g.	Nev.	.10	140,840
New Jersey Zinc	U. S.	4.00	1,400,000
Rico-Wellington	Colo.	.....	9,900
Shannon, c.	Ariz.	.50	150,000
United Copper	Wash.	.01	10,000
United Verde, c	Ariz.	1.50	450,000
United Verde Ex., c.	Ariz.	.75	787,500
Wasp No. 2, g. t.	S. D.	.03	15,000
West End Con., g. s.	Nev.	.05	90,000
Wilbert, l. s.	Utah	.01	10,000
Yellow Pine, z. l.	Nev.	.03	30,000
Holding Companies	**Situation**	**Per Share**	**Total**
California Explor.	U. S.	$0.12	28,139
White Knob, c.	Calif.	.10	20,000
Canadian and Mexican Companies	**Situation**	**Per Share**	**Total**
Amparo, g. s.	Mex.	$0.05	$100,000
Asbestos Corpn. of Can., pfd.	Que.	1.00	40,000
Coniagas, s.	Ont.	.25	200,000
Granby Con., c.	B. C.	2.50	374,963
Greene-Cananea, c.	Mex.	2.00	976,888
Lucky-Tiger Combination, g.	Mex.	.09	64,380
McIntyre-Porcupine, s.	Ont.	.05	180,514
Temiskaming, s.	Ont.	.03	75,00

The totals for the first five months are as follows: Mining and metallurgical companies, $66,229,201; holding companies, $2,779,356; Canadian, Mexican and Central American companies, $8,282,258.

Scarcity of Tinned Containers

The steps that have been taken to increase the supply of tin cans for the coming packing season are announced by Secretary Redfield, and a note of them is published in *Commerce Reports*. They consist principally in speeding up the manufacture of tin plate, in arrangements by the manufacturers whereby much of the tin plate ordinarily used in packing nonperishable goods will be diverted to the packers of perishable foods, and in the introduction of suitable substitute containers for many lines of nonperishable goods usually packed in tin. At present the canners are demanding 40% more cans than the manufacturers feel that they are able to promise.

The greatest saving in tin plate can be effected by using substitute containers for nonperishable goods, and the Department of Commerce, through the Bureau of Foreign and Domestic Commerce, is now preparing suggestions along this line. Good substitutes are now in use for packing tobacco, coffee, tea, spices, baking powder, soap powder, white lead, powdered paints, syrup, cocoa, cheese, lard, butter and peanut butter. It is suggested that packers of such products consider the use of such substitutes before ordering any further supplies of tin cans. The department will be glad to assist engineers who may state the special uses for which they wish containers to replace tin during the present emergency.

In some instances the use of substitutes may mean temporary inconvenience, but no patriotic manufacturer will hesitate to "do his bit" to prevent a serious food shortage next winter. Some manufacturers who have been approached by the department will be able to use substitutes without any sacrifice whatever. In fact, some of them will welcome an opportunity to abandon the elaborate containers that have come into use largely for advertising purposes during the last few years.

Several important concerns are already notifying their trade that in the future their goods will be delivered in substitute containers. Some tin-plate manufacturers have agreed to coöperate by refusing for the present to enter into new contracts for the sale of tin plate for use in canning nonperishable goods. Economy in the manufacture of tin plate and tin cans is of prime importance, and the manufacturers are making special efforts to prevent waste in the mills and factories.

France Wants Our Engineers

The pressing need for American engineers, railroad men and technical workmen to help rebuild the railroads, canals and highways of the devastated regions of France is emphasized in a report just made by Albert Claveille, Under Secretary of Transportation, who has just returned from an inspection of the districts evacuated by the Germans.

Mr. Claveille said that the Germans in their desire to get all the metal, especially steel that they could, carried off with them in their retreat steel rails and ties, stripping all highway and railroad bridges of metal and destroying turntables, water tanks and switch mechanisms.

"The best service that could be rendered to France by the regiment of engineers now being organized in the United States," said Mr. Claveille, "would be to bring over here as soon as convenient tools and equipment necessary to repair those railroads, canals and bridges. They should bring not only the required tools, now unobtainable here, but also laborers familiar with that kind of work and capable of quick productive efforts. The equipment in tools should be threefold the normal supply for a regiment of engineers.

"The American engineers may be of immense service to us in this work as well as in rebuilding the railroads. I want to state in this connection that in view of the present situation all units of engineers formed in the United States should be autonomous and complete in order to be of maximum utility; that is, they should bring the necessary hand labor. Only inefficient and unskilled workmen are available here now. Above all, quick workers are needed.

"If America could send us a coal mining contingent in addition to the engineering corps for railroad and canal work it would be a great boon to us."

The Assayer and Chemist

Raikow's Method for the Detection of Calcium

A method recently described in the *Chemiker Zeitung* for the detection of calcium in the presence of the other alkaline earths depends on the fact that $CaCO_3$ is decomposed into CaO and CO_2 between 600° and 900°, while $BaCO_3$ and $SrCO_3$ remain unaltered.[1]

About 1 gram of $CaCO_3$ is heated in a porcelain crucible with a Teclu burner for about 15 min., the mass transferred to a test tube, 6 c.c. distilled water added, and filtered. A drop of phenolphthalein added to the clear filtrate and also to the unfiltered portion will give each a deep red color. $SrCO_3$ similarly treated gives no color with phenolphthalein, while $BaCO_3$ similarly treated gives a pale rose color. $BaCO_3$ not heated will give this same pale rose color, however, with phenolphthalein. A mixture of $BaCO_3$ and $SrCO_3$ treated as above will give only the pale rose color that $BaCO_3$ alone gives, while $SrCO_3$ and $CaCO_3$ when so treated will give the deep red color which $CaCO_3$ alone gives when heated. Less than 0.002 gram $CaCO_3$ cannot be satisfactorily detected.

Recovery of Molybdenum from Laboratory Residues

The loss of molybdenum salts in a laboratory making many iron and steel or phosphate analyses may become a matter of commercial importance under war-time conditions. The following hints compiled from notes on this subject in the *Journal of the Society of Chemical Industry* and the *Experiment Station Record* may be of service in checking this waste.

The filtrates from phosphomolybdate precipitations should be saved and treated with sodium-phosphate solution and the waste solutions decanted day by day from the precipitate until a considerable amount of it has collected. When there are several kilograms of the precipitate to work up, it should be washed with sodium-sulphate solution once or twice by decantation and then dried in air. This dried precipitate should then be dissolved in ammonia.

The proportion of 200 c.c. strong ammonia water in 2.2 liters of water should dissolve 1 kg. of precipitate, but use a little more ammonia if necessary. The accumulated phosphomolybdate precipates in the gooches should also be dissolved out with ammonia and added to this solution.

For each kilogram of precipitate add 60 grams ammonium chloride and 120 grams magnesium chloride to the ammoniacal solution and allow the mixture to stand for a few days. Filter off the NH_4MgPO_4 precipitate which can later be dissolved in nitric acid and used to precipitate molybdic acid from mother liquors containing it. The filtrate contains the molybdic acid. If the solution is of a greenish tinge, add a few drops of hydrogen peroxide.

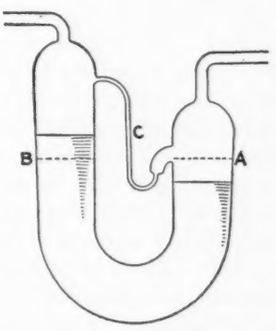
[1] "Chem. Abstr.," Apr. 20, 1917.

Evaporate the clear solution to the point of incipient crystallization of the ammonium chloride, adding several portions of 40 c.c. of 10% ammonia during the evaporation. Transfer the precipitate ammonium molybdate to a porcelain mortar and stir up well with water. Filter and wash to remove as much as possible of the chlorides and dry at room temperature. The filtrate and mother liquor may be treated for a further recovery of ammonium molybdate, the impure product being purified by recrystallization from boiling water to which has been added a little 10% NH_4OH solution.

A Laboratory Gas Meter

It is often of interest to know the rate of a stream of gas employed in a laboratory operation, and the following device has been found useful for this purpose, says E. G. Beckett in the *Journal of the Society of Chemical Industry*, Jan. 31, 1917.

The accompanying diagram shows the design of the apparatus. It is filled up to the dotted line *AB* with water, which thus fills the siphon *C* connecting the two limbs of the U-tube. When the gas to be measured enters the apparatus, it forces the level of the water down in *A* and up in *B* until the difference in pressure causes the siphon *C* to empty itself into *B*. The gas in *A* then escapes into *B* through the siphon, while the level of the water readjusts itself in the U-tube and fills the siphon *C*. The process then starts again. The siphon runs over each time after a definite amount of the gas has passed through the instrument, which amount, however, varies with the velocity of the gas. A determination of the capacity of the gas meter for different velocities gave the results shown in the accompanying table.



LABORATORY GAS METER

CAPACITY OF GAS METER FOR DIFFERENT VELOCITIES

Rate, C.C. per Sec.	Capacity in C.C.
15.5	44.5
10.0	42.5
7.61	40.5
6.56	40.0
3.75	37.5
1.93	36.5
0.54	35.4

As this siphon gas meter is made entirely of glass, it may be used for any gas which is slightly soluble in water or in the liquid used. It is especially useful for highly corrosive gases such as chlorine, for which the ordinary metallic gas meter is out of the question.

If a constant stream is desired, gas at a high pressure should be employed, and the rate regulated or throttled immediately in front of the gas meter. For gases very soluble in water, other liquids have to be used instead, but only mobile liquids can be employed.

Analysis of Aluminum Alloys

In the *Journal* of the Institute of Metals, W. H. Withey, of the National Physical Laboratory, gives some very interesting notes on the analysis of aluminum and aluminum alloys.[1] For zinc in Al — Zn alloys dissolve 1 or 2 grams in dilute HCl, dilute to 400 c.c. and add 50% NaOH (by alcohol) until the precipitate redissolves, then 15 to 30 c.c. excess, heat to boiling and pass sulphureted hydrogen into it for 10 min. Do not pass the gas longer, or Al $(HO)_3$ will be precipitated. Cool slightly, filter and wash the precipitate with boiling water containing a little sodium sulphide. Dissolve the precipitate in HCl, boil off the free H_2S, add ammonium chloride and precipitate iron and alumina by ammonia.

Dissolve and reprecipitate these hydroxides twice and determine the iron colorimetrically. Neutralize the solution and, while boiling, add to it a large excess of ammonium-hydrogen phosphate. Cool slowly and then filter on an asbestos gooch, ignite and weigh as $Zn_2P_2O_7$.

For alloys containing Al, Cu, Zn, Ni, Mg and Mn, dissolve 2 grams in 20 c.c. hydrochloric acid and 10 c.c. nitric, dilute somewhat and add 15 c.c. concentrated sulphuric acid and evaporate to white fumes, cool, take up in water by boiling, filter off and wash Si and SiO_2, ignite and weigh in platinum, volatilize SiO_2 by HF and H_2SO_4, then Si by HF and HNO_3. Withey reports both SiO_2 and Si, instead of calculating SiO_2 to Si and adding this to the graphitic Si for total Si according to the usual custom, but gives no proof that the SiO_2 exists as such in the alloy. The filtrate should measure 300 c.c. and is heated to 70° and H_2S passed to separate Cu. Determine Cu by electrolysis or otherwise. Boil the filtrate to remove H_2S, add 15 grams tartaric acid. Neutralize with NH_4OH, using only very slight excess, especially if Ni is present. Add 5 grams NH_4Cl, heat to 70°, pass H_2S; Fe, Ni, Zn and some Mn precipitate. Let stand a few hours in a closed flask, filter, wash with 2% NH_4Cl and H_2S.

Make the filtrate acid with acetic acid, boil to remove H_2S, filter off any coagulated NiS. Concentrate the filtrate to 300 c.c., cool, make slightly alkaline with NH_4OH, add a solution of 5 grams sodium phosphate. When the Mg precipitate has formed, add one-third the bulk of concentrated NH_4OH and let stand overnight. Filter, wash, redissolve in HCl, reprecipitate, after adding 1 gram tartaric acid. After ignition dissolve in very dilute HNO_3, filter off and weigh any SiO_2. Determine Mn in the solution colorimetrically and deduct the $Mn_2P_2O_7$. Determine Mn in separate portion by solution in HNO_3, oxidize with sodium bismuthate, and titrate with Mohr's and $KMNO_4$. The Fe, Ni and Zn precipitate is dissolved in aqua regia to oxidize. Separate Fe as basic acetate, redissolve and reprecipitate by NH_4OH, weigh as oxide, or use colorimetric or volumetric methods. Separate any trace of Mn by Br, separate Zn by H_2S in formic-acid solution, reprecipitate if Zn is high and weigh as pyrophosphate. Boil off H_2S and determine Ni by dimethylglyoxime or volumetrically. In discussion, W. Gemmell recommended the much shorter Mg separation of dissolving the alloy in NaOH, the Mg, Cu and Fe being insoluble and Al and Zn soluble. R. Seligman suggested that C in Al be determined by amalgamation of pure Al, when it would be decomposed by H_2O, allowing collection of hydrocarbons as well.

[1] "Chem. Abstr.," 1916, p. 2563.

Bichromate Method for Lead

A recent method for the volumetric determination of lead given by F. J. Andress is as follows[1]: The lead is separated from other metals as sulphate, then dissolved in ammonium acetate and ammonia, and the resulting solution neutralized with sodium carbonate until a heavy precipitate appears. A known volume of tenth-normal potassium-bichromate solution is then added in excess of that required to precipitate the lead as chromate. Decant through a filter and wash until free of potassium bichromate. The filtrate and washings may be titrated and the lead indirectly estimated from the bichromate found.

A direct method is to add 15 to 20 c.c. of a 10% solution of KI to the beaker containing the precipitate and dissolve the residue on the filter into the beaker with warm 1:1 hydrochloric acid. Dissolve any lead chromate sticking to the beaker with concentrated hydrochloric acid and transfer to a 6-in. evaporating dish. Add tenth-normal sodium thiosulphate solution from a burette until a yellowish-green coloration is obtained, then add starch paste and continue the titration until the blue color is discharged.

$$PbCRO_4 + 8HCl + 3KI = PbCl_2 + CrCl_3 + 3KCl + 3I + 4H_2O$$

Tin in Tin Ashes

A method for the determination of tin in tin ashes is given in *Chemiker-Zeitung,* Vol. 40, p. 458 (abstr. *Journ.* Soc. Chem. Ind., Vol. 35, p. 740). According to the author, N. Welwart, from three to 10 grams of sample should be boiled with 30 to 100 c.c. of dilute HNO_3 until nitrous fumes cease to appear. Dilute the solution with three times its volume of boiling water, boil for 30 min. and filter. Wash the insoluble portion which contains the tin, first with nitric acid and then with water, dry, ignite in a porcelain crucible and weigh.

Fuse a known amount, about 0.3 grams of the weighed residue, with a mixture of sodium carbonate and sulphur, dissolve the melt in dilute hydrochloric acid, boil the solution until all the sulphureted hydrogen has been expelled, and then dilute with three times its volume of water.

Treat the hot solution with 25 c.c. of concentrated hydrochloric acid and 25 grams of powdered antimony and boil for 30 min. in a current of CO_2.

Cool the mixture still passing the CO_2 and titrate with $\frac{N}{10}$ iodine solution, which has been standardized with a known weight of pure tin. The presence of lead, copper, antimony and zinc does not interfere with this titration, but in case large quantities of iron are present the sulphide melt should be dissolved in water and the solution filtered before adding the hydrochloric acid. The results must be calculated back to the original tin ashes.

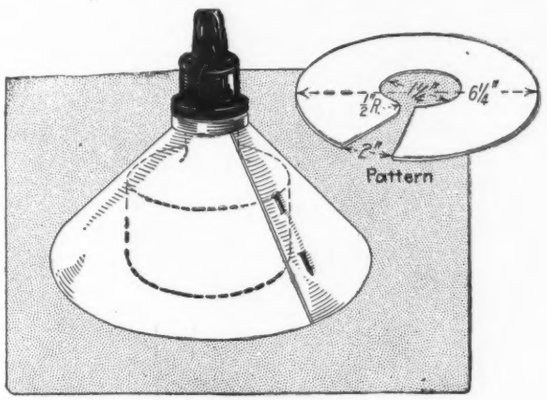
Platinum May be Precipitated Quantitatively as sulphide, according to V. N. Ivanov ("Journ. Russ. Phys.-Chem. Soc.," p. 527, 1916), in the presence of about 5 grams of magnesium chloride per 100 c.c. of liquid. In the analysis of platinized asbestos sufficient magnesium is usually taken up from the asbestos to render the precipitation complete. This means that the addition of mercuric chloride to platinum solutions is not necessary.

[1] "Chem. Analyst," Vol. 18, p. 15; abstr. "Chem. Abstracts," Apr. 20, 1917.

Details of Practical Mining

Holder for Ink Bottle

The accompanying illustration shows a quickly constructed holder for draftsmen's ink bottles, which may be made from ordinary detail paper or thin Bristol board. The holder is cut from the paper as shown in the sketch and is fitted around the bottle just under the "roll" of



BRISTOL BOARD INK-BOTTLE HOLDER

the neck and fastened in place by means of an ordinary steel pin or a small paper fastener. When in place, the bottom of the bottle should be about ¼ in. above the bottom of the holder, as shown, making a device that is practically impossible to overturn.

Effect of Material on Accidents

According to "Special Bulletin No. 77," of the Department of Labor of the State of New York, every accident indicates the presence of defects in materials, machines, methods or men, or, what is more common, in a combination of two or more of these elements. The relative weight to be given each of these factors is not constant for all industries nor for all plants in a given industry. After considerable experience one large steel plant has estimated that the efficiency of its safety work is distributed as shown in the table.

DISTRIBUTION OF SAFETY-WORK EFFICIENCY

Organization	45%	
Attitude of officers		20%
Safety committees		20%
Inspection (workmen)		5%
Education	30%	
Instruction of men		15%
Prizes		9%
Posting signs		3%
Lectures		3%
Safeguarding	25%	
Safety devices		17%
Lighting		5%
Cleanliness		3%

This distribution is suggestive at least of the nature of successful safety efforts. It indicates that the prevention of accidents can be effected neither by the mere parrot-like utterance of "Safety first" nor by the installation of mechanical safeguards alone. Carelessness and recklessness are said to be national characteristics. At any rate the habit of taking chances is one that is not confined to wage earners, and the best means of instruction is to set a good example. In the table, attitude of officers, safety committees, lectures and instructions to men constitute 58% of the total. During the period 1913 to 1916 the average decrease in the number of accidents in six of the large industrial plants of the state was 51%. It would be interesting to know the proportionate causes of accidents under the headings, men, material, machines and methods.

Handy Prospecting Drill

Having had occasion, in Snake Valley, Alberta, to drill a hole to prospect a coal seam through a stratum that was of unknown thickness and too hard for augers to penetrate and since the depth of the hole and the value of the work would not warrant the expense of hiring a machine, the apparatus shown in the illustration from *Coal Age* was rigged up by T. Edwin Smith of Carmangay, Alberta, from material secured locally, and which can be secured in any of the mining districts which boast of a hardware store.

A drill made from a piece of 2-in. cold-rolled shafting with a piece of tool steel welded to its lower end

ARRANGEMENT OF A CHEAP AND PRACTICAL DRILL

for a cutting edge; a hole punched in the upper end enabled the rope to be attached by means of a small clevis.

The frame, or derrick, consisted of four poles each 16 ft. long, bored with a 1-in. hole through each pole about a foot from the small end and a ½-in. iron rod passed

through the four poles, placing a pulley between the center pair.

The rope from the drill was passed over the pulley and down to the ground, where it was attached to a foot treadle. The treadle consisted of a 4 x 4-in. stake driven into the ground and a piece of 2 x 6 about 4 ft. long bolted at one end to the upper end of the stake and so arranged that it would swing in a vertical plane. At the other end was a hook with an opening smaller than the diameter of the rope. To attach the rope to the treadle it was drawn up into the hook, where it held with sufficient firmness to lift the drill by pressing down on the treadle. A wooden handle was attached to the down-coming portion of the drill rope, for turning the drill and to assist in lifting.

The drill was operated by pushing down on the foot treadle, at the same time lifting on the handle, then removing foot from the treadle and bearing down on the handle. A 60-lb. drill could be lifted without difficulty by this method.

A slush pump was made from a piece of 3-in. pipe 3 ft. long, with a plug fit inside of the pipe, with a 1-in. hole through it and a leather flap valve to fit over the hole in the plug and fastened to the small end of the plug with $\frac{5}{8}$-in. shoe nails.

With this outfit holes could be drilled to a considerable depth, and while it is not to be recommended for speed of drilling and ease of operation, it was a good one-man rig, being cheap and easily made.

Construction of Chutes

By S. Ford Eaton

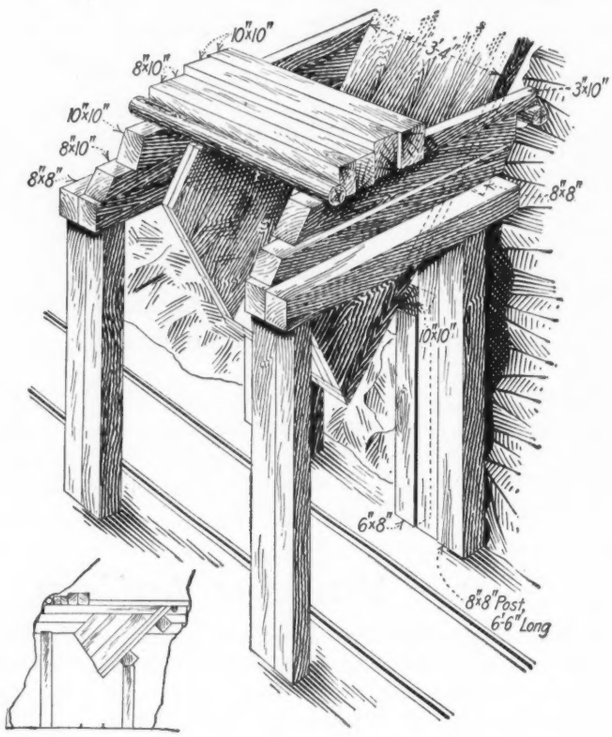
In the *Journal* of Mar. 17, 1917, an article on chute construction, by James E. Harding, appeared. A modified design has since been adopted which I believe will be of interest, and has been used for the most part at ore passes leading directly into shrinkage stopes of moderate size. The maximum life required from any one chute was not over five months. However, the ore is heavy (running 15 cu.ft. per ton broken) and all bulldozing, block-holing, etc., had to be done directly in the throat of the chute.

Prior to the adoption of this type, timbering throughout the mine levels had been done with 10 x 10-in. material. The design was due to the necessity for decreasing timber consumption by substituting 8 x 8-in. for 10 x 10-in. wherever possible. At the same time it was desired not to weaken the construction of the chutes.

The dimensions of timber are practically all that are indicated in the sketches. Most measurements are purposely omitted for the reason that they cannot be arbitrary, such factors as size of drift, cars, etc., making them variable. The best results have been obtained by having the floor built at a pitch of about 42°, clearing the top of the car by 4 in., the mouth coming not quite to the center line of the car.

Our experience in practice has been that the first portion of a chute to wear out is the front of the bulkhead over the back of the drift (bumper). In old chute construction the sides were not built so high and only one bumper was used. Rock fell through directly to the carmen when this had worn out and it was a difficult matter to repair. By building up the sides it was possible to use two bumpers placed well toward the foot wall and not decrease the vertical dimension of the chute throat—in this case 30 in. It developed that the first bumper could wear through entirely and still leave the equivalent of the old type of chute.

The method of construction is as follows: Pillar sets and lagging are installed; chute raise driven to stope floor; chute sets placed with 8 x 8-in. stull caps; 2 x 8-in. slabs forming caps for posts. Next, 8 x 10-in. stringers are placed flush with chute-set caps (if 8 x 10-in. timber is unavailable, use 2 x 8-in. and 8 x 8-in.); then 10 x 10-in. top stringers, inset 4 in. to protect the ends of side boards are placed. Determine and mark line of bottom of floor; 8 x 8-in. and 10 x 10-in. spreaders are placed to this line. After the latter is in place, frame the ends to allow for placing supporting standards of 6 x 8-in. material. Next, the first layer of floor is placed, using



CONSTRUCTION OF CHUTES

2 x 6-in. at sides; second layer, all 2 x 12-in., making staggered joints. The sides are double 2-in. material, two sets of 2 x 12-in. on each side, top double 2 x 6-in. Place 10 x 10-in. bumpers at the required vertical distance from floor, spike down and hold in place with 3 x 10-in. slabs to foot wall on 10 x 10-in. stringers and the necessary amount of bulkheading to hanging wall.

Door cleats and doors are put in last. These have been omitted from the sketches to avoid confusing lines and can be built in any desired manner. For ordinary stope run of coarse rock two door gates have proved satisfactory. Three doors are better if it is known that the rock will run fine. With heavy rock the use of 3-in. material instead of 2 in. will make a saving of 30% in breakage. With reference to time required, it may be estimated that two men broken into this work with timber framed to given lengths only and delivered promptly can start with the chute drift sets and complete the chute in 20 hours.

Mining and Metallurgical Machinery

Decimal Split-Hand Motion-Study Watch

The watch illustrated has recently been brought out by Mortimer I. Silberberg, 122 South Michigan Ave., Chicago, and is a high-grade split-hand watch with a decimal dial divided into tenths and hundredths of a minute, and contains figures spaced two-hundredths of a minute apart. The combination of this dial with a split-hand watch constitutes an improvement which will greatly facilitate time and motion study, as both the productive and non-productive time of an operation can be obtained at one observation, whereas on the single-hand instruments two readings are necessary to obtain this result.

DECIMAL SPLIT-HAND MOTION-STUDY WATCH

Plane-Table Alidade With Elbow Eyepiece

A light-weight alidade has recently been placed on the market by W. & L. E. Gurley, Troy, N. Y., with a 10 x 2¾-in. blade and an 8-in. telescope with elbow eyepiece, which is called an "explorer's" alidade. It is a companion instrument to the same company's "Explorer" transit and "Explorer" level. All three instruments may be carried in a 24-in. suitcase. The chief feature of the new alidade, aside from its light weight and small size, is the elbow eyepiece. This is designed to relieve the fatigue and inconvenience experienced in observing with the ordinary plane-table alidade. The new eyepiece also increases the range of the instrument, making possible readings with the telescope depressed 25° or elevated to 30°. The price varies from $90 to $120, according to equipment.

PLANE-TABLE ALIDADE WITH ELBOW EYEPIECE

Stockpile Car for Iron Mines

The Lake Shore Engine Works, of Marquette, Mich., has built a type of car for the Buffalo Iron Mining Co., of Iron River, Mich., which is especially adapted to stockpiling from temporary trestles. It is built of wood, so that it may be quickly repaired should it be damaged by an unusually large piece of ore being dumped into it, steel lining protecting it from excessive wear. The truck is made of 8 x 8-in. timbers strongly braced with through bolts; the sides are made of 3¼-in. oak with 4 x 6-in. frame and lined with $\frac{3}{16}$-in. plate. Hyatt roller bearings

STOCKPILE CAR USED BY BUFFALO IRON MINING CO.

3 x 7 in. with 4-ft. wheelbase and 16-in. wheels are used on a 30-in. gage track. The dimensions of the truck are: Length over couplings, 9 ft.; extreme length of hooks, 5 ft. 10 in.; height from rail to top of car, 5 ft. 3 in.; inside dimensions of box, length 6 ft., width 4 ft. 5 in., depth 3 ft. 5 in. The capacity is 60 cu.ft.

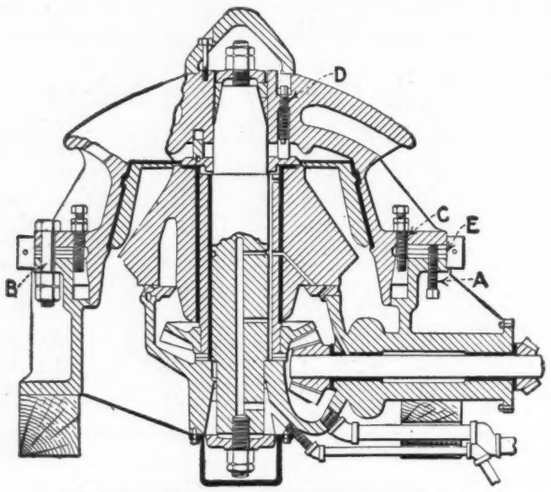
It is operated by an endless rope, and its advantages are its reliability under all kinds of weather conditions, low operating costs and elimination of dangers of car riding.

Telsmith Reduction Crusher

The Telsmith reduction crusher is a secondary machine, intended to follow an initial breaker. It is not a pulverizer, although it will pulverize a part of its product. It is not a breaker, since the feed opening is too small to take the ordinary mine or quarry run. The crusher is designed to take the oversize pieces from an initial breaker of either gyratory or jaw type and break this

oversize down to pass ½-, 1- or 2-in. ring, as conditions may demand. It might be supposed that, because the feed is smaller, this class of work is less difficult than initial breaking. The reverse is claimed to be true. The finer crushing consumes more power per ton of rock crushed and subjects the equipment to far greater strains. For this reason, strength and rigidity are of the greatest importance in an intermediate crusher.

The crusher is an adaptation of the Telsmith rigid-shaft breaker. The chief point of difference is in the

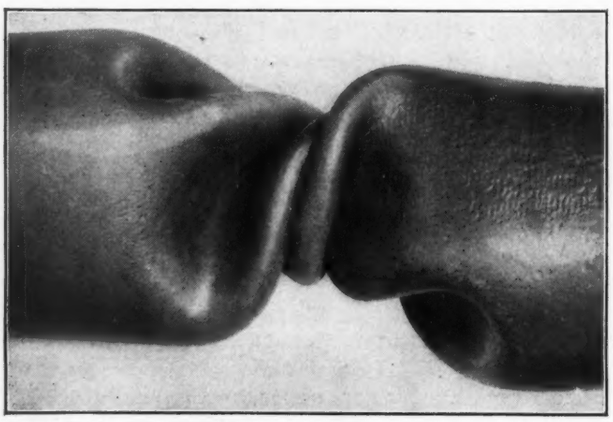


THE TELSMITH REDUCTION CRUSHER

head, which is made low and flat. The frame is even shorter and stockier than in standard gyratories. It is cast in two pieces, walled and ribbed to withstand enormous strains. The shaft is rigid as in primary breakers, but is shorter for its diameter. The top spider is cast into the the upper section of the frame. The spider arms are short, heavy and practically unbreakable. The bottom spider is cast into the lower section of the frame, with four big arms and a huge hub.

Torsional Strength of Pipe

It is doubtful if it is generally known what the ordinary line pipe will stand. The accompanying illustration shows the result of a 713,000-lb. torsional stress on a piece



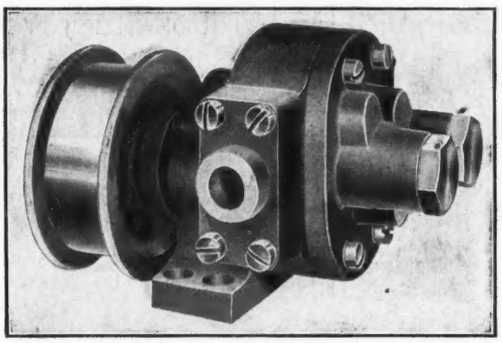
TWISTED WROUGHT-IRON PIPE

of 8-in. line pipe manufactured by the National Tube Co., of Pittsburgh, Penn. This pipe, with walls of approximately 0.33 in., weighs about 29 lb. per foot.

Gear Pump for Cooling Oil

The Inter-State Machine Products Co., Inc., Rochester, N. Y., has placed on the market a pump for circulating cooling oil on lathes, screw machines and other machine tools.

The pump is of the well-known gear type, the one shown being equipped with automatic relief valves—a feature



GEAR PUMP WITH AUTOMATIC RELIEF VALVES

that allows the operator to shut off the liquid at the point of discharge without creating undue pressure in the pump and makes the use of an auxiliary relief valve unnecessary. Pumps are also furnished without the automatic relief valves, if so desired. Steel gears are used. The weight of the pump is 11 lb., and its capacity is 1¾, 2¼ and 2¾ gal. at 300, 400 and 500 r.p.m. respectively.

Adjustable Drafting Board

The Improved Drafting Board Co., of Nashua, N. H., has placed upon the market a new adjustable drafting board, which is mounted upon an enameled base. As shown in the illustration, this board, which is 28 x 40 in.

ADJUSTABLE DRAFTING BOARD

in size, may be tilted to any angle, balancing weights being concealed inside the large frame tubes.

Events and Economics of the War

The greatest military event of the week was the continuance of the strong Italian offensive along the shore of the Adriatic, threatening Trieste. This has already resulted in the taking of upward of 20,000 prisoners and many guns.

In the great aeroplane raid on the southern part of England, May 26, many non-combatants were killed.

In the United States, June 5 was named as registration day. Herbert C. Hoover was appointed food administrator. General Goethals came out against the program for building wooden ships and is making arrangements for standardized steel ships.

War Makeshifts in Germany

No one who has had the opportunity of reading the German chemical journals issued since the outbreak of the war can fail to have been struck by the way in which they have served as a focus for the German characteristics of forethought and resourcefulness, says a writer in the *Journal of the Society of Chemical Industry,* London, Mar. 31, 1917. Most of the national wants have been foreseen long before they occurred, and whenever it has been possible the chemist has found a substitute, although not always an efficient one.

Many of the devices suggested or adopted have been mentioned from time to time in this *Journal,* but in most cases incidentally and in connection with other questions, and a short summary of the steps which Germany has taken to meet some of her most pressing needs may therefore prove of interest.

Early in 1914 Germany foresaw that the struggle upon which she had then determined would be essentially a petrol war and that every gallon of petrol would be required by her fighting services, and so the outbreak of the war found all the motor vehicles in Berlin, down to the taxicabs, provided with engines adapted to consume either petrol or alcohol. As some difficulties were experienced in using alcohol by itself, systematic experiments were made with mixtures of alcohol with benzene and other hydrocarbons, and the formulas giving the best results were published in the chemical journals.

The first plant for the fixation of nitrogen from the air was established in Germany not many months before the war, and at the present time the bulk of the nitrates required for the manufacture of her explosives is derived from that source. Nor is this the only direction in which nitrogen obtained from the air has been utilized. With the increasing strictness of the British blockade it became essential to discover a substitute for nitrogenous feeding-stuffs for horses and cattle, about 500,000 tons of which had been imported prior to the war. To meet this deficiency it was suggested to the authorities that a special yeast, which had a vigorous growth but produced no alcohol, should be cultivated and pressed on a large scale. This work has been carried out under the direction of the Institute of Brewing in Berlin. Enormous shallow tanks, like swimming baths, have been erected, and in the bottom of these are fitted pipes to maintain the optimum temperature for the growth of the yeast, which is cultivated in a medium prepared from refuse material from the sugar works mixed with suitable salts, including ammonium salts obtained synthetically from the air. The compressed yeast is stated to be suitable not only as a nitrogenous fodder, but also for human food. It is estimated that before long Germany will be in a position to obtain from this source the whole of the nitrogenous fodder she requires, and that she will never again be dependent upon the outside world for her supplies.

In connection with feeding-stuffs it is significant that attention should at once have been directed to the utilization of kitchen refuse. Within two months after the outbreak of the war a notice was issued by Prussian municipalities that all householders were required to sort their kitchen refuse. All fatty material was to be kept separate, while the vegetable material was to be saved for fodder. As subsequently organized, more especially in the larger towns, it was prescribed that the fatty material should be taken to specified soap works, where the glycerin was to be separated and the soap returned to the householder. No one is allowed to make any soap privately.

One difficulty in dealing with the vegetable matter was the necessity of drying it quickly to prevent putrefaction, and it was suggested that the waste heat of the gas works should be utilized in this way, although subsequent issues of the journal do not state whether this has been done. Still more recently attention has been directed to the annual loss of potatoes by disease, and it is suggested that frost-bitten or diseased potatoes should be dried and used as an ingredient of fodder, or that they should be used in the preparation of starch. While Germany has been making use of kitchen refuse in this way for over two years, it is only within the last month that any proposal to prevent this loss in this country has been put forward.

The lack of oils and fats has been Germany's greatest difficulty and she has been able to supply her wants of nitroglycerin only at the expense of the health of the community. Hence the chemical papers have constantly published the results of the analyses of little-known home-grown seeds, which have never before been regarded as possible sources of oil. It has been shown that asparagus and other vegetable seeds contain a considerable proportion of oil, though it is doubtful whether they would repay the labor of extracting it. In two cases, however, the suggestion of the chemist has borne fruit. Horse-chestnuts are now systematically collected both for the separation of the large amount of oil which they contain and for the preparation of a saponin extract to take the place of soap; while in southern Germany the National Women's Guild has made itself responsible for the collection of the enormous quantities of cherry stones, which were previously thrown away. These are crushed and the kernels separated by an ingenious method of treatment with a solution of a salt of such specific gravity that the kernels float on the surface while the shells sink.

The kernels are then dried, and the oil is expressed in the usual way. By means such as these Germany has made great additions to her supplies of oils, but the deficiency is too great to be materially alleviated by device any short of the synthesis of fat.

Mention might also be made of the various detailed experiments that have been carried out to discover palatable substitutes for tea, coffee and cocoa, and of those upon which the composition of the so-called war bread has been based. In every direction the German places himself in the hands of the expert chemist, and it is only the lack of raw material in certain essential particulars, which has prevented the chemist from solving every material difficulty with which Germany is now face to face.

Professional Classes War Relief

American contributions to the Professional Classes War Relief Council of London, have aggregated $11,793.25 up to May 12, according to the Farmer's Loan and Trust Co., which is receiving the contributions. Major Leonard Darwin, chairman of the council, has written to Lewis D. Stillwell, in charge of the American collections, a letter thanking the contributors for their generosity, and adding the following paragraph:

"In the interests of your own country, and in order to safeguard the civilization of the world, you also have been compelled to join in this terrible strife, and I am certain that, though our beneficiaries would have been deeply grateful to you in any case, yet it is far pleasanter for them to receive this succor from the hands of an ally. All of them and all of us will ever remember America's help in the hour of our need."

Urges Better Car Loading

The following statement is authorized by President Harrison, of Southern Ry., chairman of special committee on National Defense of the American Railway Association.

Because needs of the government and commercial interests for box cars will in all probability be greater during the war than ever before, railroad special committee on National Defense, in charge of operation of the railroads as one system during the war, has issued a bulletin to presidents of railroads calling attention that on an average only 43% of capacity of box cars is utilized under present loading practices.

More box cars must be made available for urgent needs, and the way to do it has been put up to the carriers who in turn, have been instructed to coöperate with shippers.

Average freight car has a capacity of 39.7 tons. Average load of revenue freight is 15.5 tons, and of "company" or railroad freight, 17 tons, or only 43% of capacity. Railroad men are advised "to concentrate efforts on a few friendly shippers at first to lead the movement and set the example."

These are a few of the things the railroads ask shippers to do as a patriotic duty.

"Do not ship beyond ability to handle promptly.

"Extend your private side tracks to keep pace with your increased business, and in this way avoid necessity of delaying cars.

"Arrange time of your shipments so they will be made uniformly, when possible.

"Ship at periods of the year when cars are not badly needed for moving crops.

"Do everything possible to keep cars moving, so everyone, railroad and shipper, can accomplish the maximum amount of efficiency for the nation in this great crisis."

Military Census of New York

New York State proposes to take a census and inventory of the military resources of the state under laws passed this year and the State Military Law. A director of the census has been appointed for each county and one for the City of New York. E. P. Goodrich, member of the American Society of Civil Engineers, has been given the latter post. A preliminary enumeration has shown that in Greater New York there are about 3200 factories and mercantile establishments in which are employed 400,000 persons, or more than 10% of the estimated total military population of the state. It was believed that this large group of persons could be readily segregated and returns secured from them in their places of employment.

Director Goodrich has asked Alfred D. Flinn, member of the American Society of Civil Engineers, to organize a volunteer force from among the engineers of the various branches of the profession in New York City, to take this part of the census. It is estimated that 350 or more engineer canvassers will be needed, each giving two full days or more of his time. Letters giving further information and forwarding pledge cards will be sent to the engineers of New York City in the very near future. If any of our readers are able to help and do not receive such an invitation, they may communicate with Director Goodrich or Mr. Flinn at 261 Broadway, Room 904.

Woodsmen Going To Front

A forestry regiment, composed of foresters, woodsmen and others experienced in lumbering operations, will go to France as a unit in the expedition of army engineers now being recruited. It will be organized as a volunteer military force, and will assist the engineers in preparing timber for construction work.

The duty of the force will be to convert available timber into material suitable for bridges, railroads and trenches with the least possible waste. Its equipment will include several portable sawmill outfits. It will be officered by trained foresters and expert lumbermen familiar with producing and delivering lumber. The classes of men desired comprise axemen, teamsters, tie cutters, millwrights, saw filers, sawyers, portable sawmill men, farriers, blacksmiths, lumberjacks, cooks, carpenters and motorcycle and motor truck operators.

War Army Bill

Final action was taken by Congress on May 17, on the army bill, the second of the major measures of the war. The Senate, by a vote of 65 to 8, adopted the conference report accepted previously by the House. Vice President Marshall and Speaker Clark signed the bill on the following day and sent it to the White House for President Wilson's approval.

As finally approved the bill provides for raising, by selective conscription, a war army in increments of 500,000 men from 21 to 30 years of age. It also authorizes, without directing, the President to raise volunteer forces which Col. Roosevelt desires to take to France, and greatly increases the pay of all enlisted men.

Machinery to register and draft the first 500,000 men already had been set up by the War Department. Immediately after the President signed the bill he, by proclamation, designated June 5 the day for registration of the 10,000,000 or more men of the prescribed age. Registration books will be in the hands of state and local authorities who are to coöperate, and Brig.-Gen. Crowder, the Provost Marshall General, expects to have his complete lists in Washington within five days after registering begins. Actual training of the men will begin September 1.

Chief Provisions of Army Bill

The Army bill, backed by the Administration, was introduced in the Senate Apr. 19, was passed Apr. 28—in the Senate by a vote of 81 to 8 and in the House 397 to 24. Its chief provisions are:

Raising of armed forces by the selective draft system, imposed upon all males between the ages of 21 and 30 years, inclusive, subject to registration and certain exemptions from service.

Increasing the regular army to maximum war strength.

Drafting into the Federal service of National Guard units.

Raising of an initial force by conscription of 500,000 men, with addition of 500,000 if deemed necessary.

Raising, if the President sees fit, of four divisions of volunteer infantry. (The Roosevelt amendment.)

Increasing the pay of all enlisted men as follows: $15 additional monthly for those now receiving less than $21, comprising the bulk of the army, graduated downward to $6 additional monthly for those receiving $45 or more.

Prohibiting sale of liquor at or near army training camps and otherwise protecting morals of the soldier.

Military Registration Day

Registration day for military service, June 5, 1917, will be made the occasion for patriotic enthusiasm all over the country. On the theory that a whole-hearted enthusiastic registration of several million men will hasten the day of peace, general celebrations will be held for the purpose of doing honor to those who register. There will be talks by officials, all sounding the high note of patriotism.

The place of honor in local parades will be given to young men of registration age. Other participants will be uniformed troops, boy scouts, women's clubs, and such organizations as can turn out in sufficient number to make a showing. Every business place and residence will fly the flag, but no costly decorations will be encouraged.

Church and fire bells will be rung and other impressive demonstrations made at the hour of opening the polls. Committees of men and women will be at every registration booth to pin an emblem on each man who registers. This may be a red, white and blue ribbon or possibly a button bearing the words, "I am registered—are you?"

As this movement is to secure a large registration no effort will be made to draw people from other registration communities. The State Council of Defense, the Chamber of Commerce of the United States, and the National Committee of Patriotic and Defense Societies urge all their representatives and all city officials throughout the country to formulate immediately plans for the local celebration of this most significent event.

Bureau to Promote Friendly Relations with Russia

The Rusian Information Bureau, with headquarters in the Woolworth Building, New York City, has been established for the purpose of promoting and developing friendly relations between Russia and the United States. Its chief object is to furnish American interests with accurate and reliable information in regard to industrial, commercial and agricultural conditions in Russia in order that it may assist American interests in coöperating in the development of the Russian field.

The work of the new bureau will be carried on under the direction of Prof. B. E. Shatzky, of Petrograd, and A. J. Sack, staff correspondent for the official publications of the Russian Ministry of Finance.

Economizing Locomotives

"We have 14,000 engines engaged in the passenger service of the railroads," said Daniel Willard at the recent conference of Governors. "By readjusting the passenger schedules, especially on those railroads which parallel each other between common points, we estimate that we can divert 4000 passenger engines, capable of handling freight trains, to the freight service.

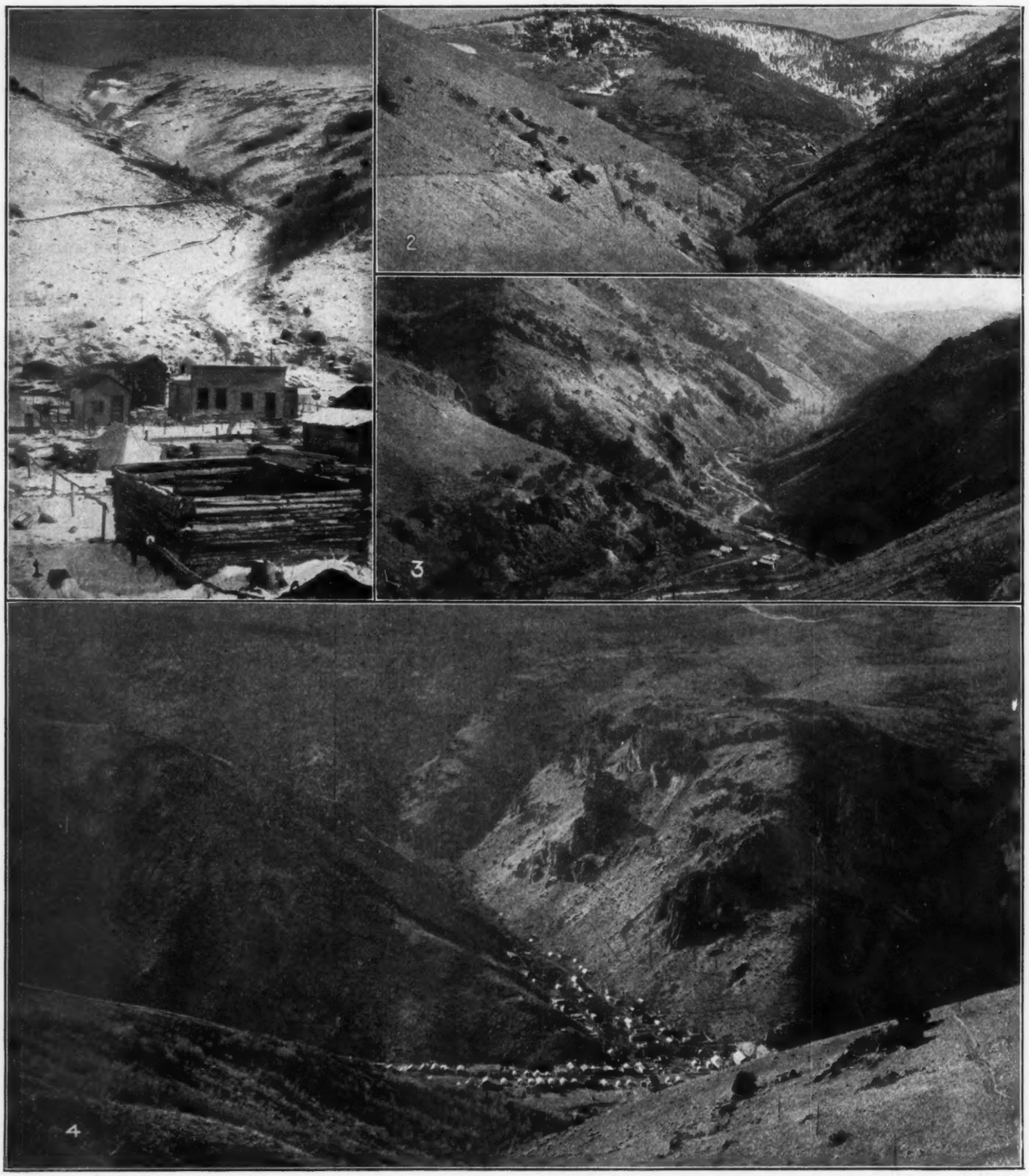
"We are also working on plans for the utilization of the inland waterways to help relieve the railroads of freight congestion. We believe the Mississippi River can be more extensively utilized in hauling coal and flour up and down the Mississippi Valley. We are now working on plans to utilize our highways also."

Director of Shipping Traffic

The Federal Shipping Board on May 9 announced the appointment of David L. Ewing, of St. Louis, as director of traffic for the Board and for the Emergency Ship Corporation, which, under the management of Maj.-General George W. Goethals, is to build the fleet of wooden ships. Mr. Ewing has been assistant general freight agent of the St. Louis & San Francisco railway. He will handle delivery and shipment of supplies for shipyards building the fleets. Later, when the Board gets its ships on the water, he will supervise the work of providing their cargoes. The Shipping Board's steel shipbuilding campaign will follow closely the lines laid down for the wooden program. The Emergency Ship Corporation will direct the work. Plans are about completed for standardizing all steel cargo ships to be built in this country's yards.

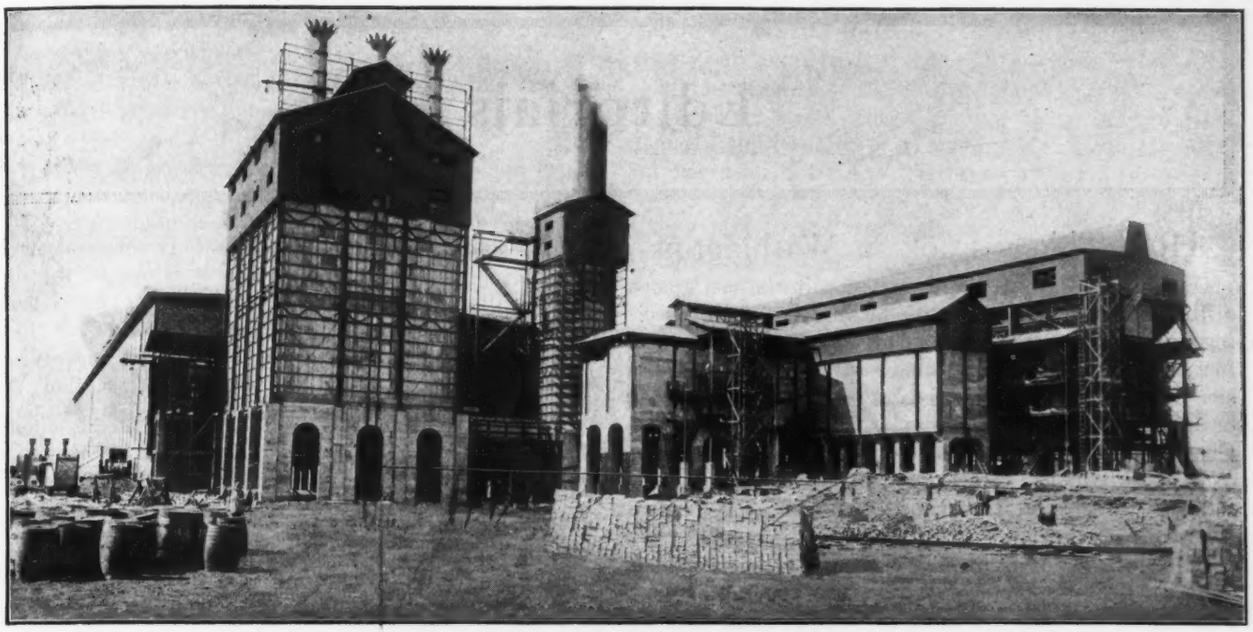
The Composition of the Alloys used in Zeppelin construction is reported to be as follows: Angle brackets, Al, 90.27%; Zn, 7.8; Cu, 0.73%; Fe, Si, Mn, Sn, traces. Channel sections: Al, 88.68%; Zn, 9.1%; other constituents about as in the angle brackets. The braces were apparently commercial aluminum of about 99% purity.

Photographs from the Field



VIEWS IN JARBIDGE GOLD DISTRICT IN ELKO COUNTY, NORTHERN NEVADA

This gold camp has been revivified by the entrance of the Guggenheim interests, through the Elkoro Mines Co., a subsidiary of the Yukon Gold Co., which took over the Hanford interests in the Starlight, Jarbidge Gold and Flaxie; besides these mines, it controls the important Long Hike, O. K. and Buckeye. The Wingfield interests also have properties under option in this district. The view marked (1) shows the Long Hike office and mine with four adits in the upper part of the hill. View 2 is looking up Bourne Gulch, showing the Flaxie, Starlight, Legitimate and Alpha mines. No. 3 is a view up Jarbidge Canyon at the junction of Bourne Gulch, and shows the Hanford offices and Red Warrior claim. View No. 4 shows the town of Jarbidge, taken from the Long Hike mine, looking up Bear Gulch



NEW SULPHURIC ACID PLANT OF CALUMET & ARIZONA MINING CO. AT DOUGLAS, ARIZ.

This plant was designed by the Process Engineering Co., of Philadelphia, Penn., and was placed in operation in April. It has a nominal capacity of 250 tons of 50° Bé. acid, and the principal part of the output will be used for leaching the ores of the New Cornelia Copper Co. at Ajo, Ariz. In the illustration, from right to left, are the roasting furnaces, dust chamber and niter plant, Glover tower, in background the six acid chambers, and in front at left the Gay-Lussac tower

INTERIOR VIEW OF NO. 2 CHANGE HOUSE AT WASHOE REDUCTION WORKS, ANACONDA, MONT.

The efforts of the Anaconda company to promote the comfort and well-being of its employees are manifest in this view of one of the new change houses at Anaconda. It is heated by steam and thoroughly ventilated through windows in the louvre and also by windows in the walls; on each side of the change room, are well ventilated steel lockers; in the center, the enameled wash basins and sanitary drinking fountain; in the background are shown the hot-water heater and shower baths; there is an additional group of shower baths at the end of the room from which this view was taken

Editorials

How Things Look in Washington

On Friday, May 25, there was an editorial conference of the technical, engineering and business papers in Washington, which was addressed by six members of the Cabinet and by numerous members of the Advisory Commission of National Defence, chiefs of committees, and heads of bureaus. Mr. Vanderlip, president of the National City Bank, presented the views of financiers. Many subjects of importance were explained and discussed. Our readers will be interested in the gist of the ideas that we got at this conference.

Summarizing: It is necessary to arouse the people of the United States to the fact that this country has entered a war for democracy and liberty. We are fighting for the same principles that we did at Lexington and Bunker Hill. It took the leaders of the nation more than two years to awake to this. There is a large part of the people that does not know it yet. Their eyes must be opened. We have got to fight the war with every ounce of our power. The war may last from two to five years. We must be prepared for a long war.

The Administration has not been inactive during the two months since the declaration. On the contrary much has been accomplished. The German ships interned in our ports were promptly seized and rapidly are being repaired. Liberal financial aid has been extended to Great Britain, France, Russia, Italy and Belgium. The British and French have been relieved of the naval patrol of the North and South Atlantic. A flotilla of destroyers has been dispatched to British waters. An engineering commission has been sent to Russia to help move freight westward from Vladivostock. Nine regiments of engineers have been ordered to France to help repair the railways behind the lines. A division of regular infantry and artillery is being prepared for early departure.

The most urgent need of the British and French is for medical assistance. Both countries have been drained of their physicians and surgeons. The mortality among the medical corps has been in greater ratio than in any other, not excluding the aviation. The French and British commissions asked for our prompt assistance and we were ready to give it. A large number of doctors and nurses have already been dispatched abroad, and more are being sent regularly.

Instead of there being reason for fault-finding with the Government for not doing anything, we think it really is entitled to praise for having done so much.

We were told that when the new army is mobilized, next September, the arms and equipment will be ready. The greatest problem of the Munitions Board is to build the 16 cantonments, each to accommodate about 32,000 men in the short time remaining. This means the building of 16 large cities, with dwellings, warehouses, waterworks, lighting systems and means for disposal of sewage.

Important steps have been taken with regard to the distribution of coal supplies, and in coördinating the railway service of the country. Howard Elliott said that in doing the latter the American Railway Association is spending $500,000 per annum. This is one of the disgraceful things in Washington. Mr. Hoover, as food administrator, is personally paying the expenses of his office. So it is with all of the other new officers. Congress has neglected to legalize them or provide appropriations for them. Congress is the great, unwieldy, inefficient body in the Government.

The several bureaus of the regular departments are doing much good work. There are weak spots. Thus the delay in placing contracts for copper and lead, which has been playing the mischief in those markets. With regard to shipbuilding there has been some controversy between Mr. Denman and General Goethals. Congress has been relieving itself of some of its accumulated venom against the President by attacking his plans for food administration and other essential things. Such outbursts, such examples of inefficiency are perhaps to be expected. But on the whole we got the impression that matters in Washington are going fairly well. Not all of these things were talked about in the editorial conference. We have simply been summarizing our general observations.

Mobilize Yourself

Thousands of our citizens—men and women—have asked "What can I do to help my country?" All want to do their bit. Those who are going to find opportunity in the military services are relatively few. The conscription at first is going to take only 5% of the men between the ages of 21 and 30. Triple that figure to allow for the regular army and navy and the national guard. Estimate 10 men in the fields and factories for each one at the front. The total absorbs but little more than the male population between the ages of 21 and 30. It does not take account of the boys and the older men, or the women of all ages. Yet there is work for every one of them to do.

The people of the country have got to support the men afloat and at the front, and those who are in the munitions factories and in the fields growing food to feed the others. This must be paid for out of the future savings of the nation. It is the duty of every man, woman and child to increase those savings, by raising their personal efficiency and by reducing wastes.

Mobilize yourself. Speed up. Cut out your wastes.

The idler is an enemy of the Republic. So is the waster.

Mister Plumber, when you go to John Easyman's house to stop a leak and forget to take your tools with you and charge him up with a dollar's worth of time while you are getting them, you are subtracting from his ability to pay for the Liberty bond that he has subscribed for and *you* have been guilty of an unpatriotic negligence.

Mister Highroller, when you are spending a night along the Great White Way you are consuming luxuries which

represent the labor of men who should be growing wheat or something else that is essential.

Mister Joyrider, why should you burn gasoline that the transport service needs and serves no useful purpose to you?

Mistress Mary, consider what slavery to fashion means in the consumption of wool, cotton, flax and labor.

There are many ways of self-mobilization and each one doing his bit.

The Flotation Litigation

When the Supreme Court rendered its famous decision a few months ago upholding the Minerals Separation patents on the basis of less than 1% of oil, most people thought that this litigation was ended. That is usually so when the Supreme Court decides. In this case it was a good deal of a departure for the Supreme Court even to consider it. There was great surprise when it granted the writ of *certiorari* following the decision of the San Francisco Court of Appeals. Then after a long delay the Supreme Court not only listened to the arguments, but also permitted evidence to be offered; and decided. This was supposed to have settled everything except some questions respecting the Callow process, involved in the Miami case, which was pending before the Philadelphia Court of Appeals, and nothing remained except for Minerals Separation to collect its royalties.

The shining target was, of course, the Butte & Superior company, which probably has profited more than any other from the use of the flotation process. The great case focussed on its use of the process, although the suit had been against Hyde as the infringer. It was necessary therefore to bring a new suit against Butte & Superior, especially for the purpose of establishing its infringement and assessing the damages.

About this time there began to come news that Butte & Superior and other people were using more than 1% of oil and were getting results as good as with less than 1%. Mr. Megraw lately contributed an illuminating article on this subject to the *Journal*. We refrain from passing any firm opinion on the evidence there offered. It looks as if the results with plus 1% oil are not yet so good as with minus 1%, but that, perhaps, with further experience they might become so. But if that should prove to be the case what happens to the Supreme Court decision, which was distinctly founded on the theory that at somewhere below 1% oil there is a critical point at which a useful result occurs that does not occur otherwise, and that the discovering of that was the Minerals Separation invention?

The Minerals Separation people rose to the occasion by filing in the patent office a disclaimer, which had the effect of giving it a claim upon any process, whether more or less than 1% of oil is used, that produces the same result as when less than 1% oil is used. This opened the doors to the introduction of new evidence at Butte and apparently the case is going to be tried all over again. This seems to leave the Supreme Court standing high and dry, indeed looking rather foolish, but maybe that is not so.

The new arguments pro and con appear to be that (pro) there is no such thing as a critical point, the Supreme Court having been fooled; and (con) there is a critical point at less than 1% of oil, but that a larger quantity of oil may give the same result, the excess playing no particular part.

In the meanwhile the Philadelphia Court of Appeals has rendered a decision in favor of Minerals Separation in the Miami case, which seems to nail Callow. However, you never can tell. About the time when a final decision is obtained in the Butte & Superior case, just started Callow may be ready to begin again. If we have failed correctly to state the present positions of this litigation we crave the indulgence of all the litigants and especially of our readers. We admit that its intricacies are getting rather beyond us. We have an idea, however, that unless the several parties get promptly together the patents will expire before they yield royalties and then there will be nothing to do but bury them. Everybody in the mining industry would welcome a termination of this litigation.

More Work for the Fool-Killer

The House of Representatives apparently comprises its quota of fools. It was inadvertently that we said "apparently." Hasn't everybody always known it? The following dispatch to the New York *Times* from Washington, May 24, exhibits the existence of ideas that might be entertained in an insane asylum.

Debate on the Food bill in the House today developed a criticism of Bernard Baruch and Herbert C. Hoover, by Representative J. Hampton Moore, of Philadelphia, who contended too much power was being given to them by the Government. During the discussion Speaker Champ Clark, taking the floor temporarily, demanded prosecution by the Department of Justice of "the men who keep the price of copper up to 30c." This followed remarks by Representative Lunn, of New York, who resented slurs put upon Mr. Baruch by J. Hampton Moore, of Philadelphia, who had opened the debate.

"Mr. Baruch," said Mr. Lunn, "has secured for the Government a price for copper around 16c. instead of the 34 or 35c. which it was bringing on the open market at the time. That was a saving for us of millions of dollars. He also secured a reduction in the price of steel that was tremendously favorable to the Government."

The Speaker thereupon said: "You say that Mr. Baruch got 16c. for copper, but do you know that the Utah Copper Co., in its report to its stockholders, declared it could put copper free on board cars at 5¼c. per lb."

"If that is a fact," said Mr. Lunn, "we have made a tremendous mistake in our revenue bill that we did not put on an excess profits that would take care of that."

"I think so, too," said Speaker Clark, "but the Utah Copper Co. says it can deliver the copper at 5¼c. at the cars, and Mr. Baruch thinks we have brought it down to 16c. Why does not the Attorney General hop onto those fellows that put copper up to 30c.? I am willing to give Baruch credit for pulling it down from 30 to 16c., but he did not pull it down far enough. The Attorney General should put every one of those fellows in jail between now and Saturday night who keep the price up."

Representative Greene of Iowa said Mr. Baruch was not responsible for the low price to the Government for copper. He added:

"The copper was offered to the Government by the copper trust voluntarily, but I think, with a very definite purpose in mind when the offer was made. The House will remember that at a previous session there was a tax placed on copper in the revenue bill, but it was stricken out by the Senate. In my judgment it ought to have been taxed, and they should have been included in the industries that were taxed on account of enormous profits they were making."

In opening the debate Mr. Moore said he was opposed to the appointment of a "food dictator," and that men in the departments of the Government were capable of handling such matters as were to come under the supervision of Mr. Baruch and Mr. Hoover.

Mr. Moore further complained that Mr. Hoover was reported to be working at a salary of $1 a year, and said that the position should be turned over to some one who needed the money. It was an insult to the American working men, Mr. Moore said, that Mr. Hoover should insist that all his assistants receive no compensation.

It looks to us that Mr. Moore, of Philadelphia, would be a good man to put in charge of things if the United States wants to lose this war. But seriously, we consider a member of Congress who can think and say such things is an enemy of the Republic, who ought to be interned.

To Congress

The people want you to go home.

Your constituents want it. The whole people want it. They don't think you know how to run a war. They don't want you to try. They think you are messing things up. They have confidence in the President—the commander-in-chief. They have confidence in Mr. Lansing, Mr. Lane, Mr. Hoover, Mr. Willard, General Goethals and many others of the administrators. They have no confidence in you.

The people want you to go home.

There are some enabling measures that you have got to pass, so as to give the President the necessary power. You have got to appropriate moneys, you have got to give the President means for managing railway transportation, controlling the food problem, restricting exports, and some other things that have been demanded. You have got to pass the revenue measure. Well, do those things quickly and then go home.

The people want you to go home.

You are the duly elected representatives of the people. The chances are that you are a pretty fair sample of them. Perhaps you average better than the mass. Anyway, it is to be hoped so. The people through you have said they wanted to go to war. You have expressed the voice of the people. That's about all there is any need for you to do. The people in mass can not conduct a war. Nor can you. Cease trying. A stockholders' meeting cannot conduct the affairs of a company. They have to leave it to their experienced administrators. Your position is that of the stockholders. You may not appreciate it, but so it is. You take yourselves too seriously.

The people want you to go home.

Whether you like it or not, a war can be run successfully only in an autocratic way. In the democracies of the past it was found necessary to suspend popular rights and put the control of everything in the hands of the military leader when a state of war began. Those democracies, like Poland, which failed to learn that lesson, died. Will you have America die, while you hold up your hands in horror over the invasion of your "rights" as representatives of the people? Rights! In such a juncture as this you have no rights. See to what your failure to listen to the prophets of preparedness during the last two years has brought us!

The people want you to go home.

BY THE WAY

The Naval Consulting Board has received thousands of suggestions for counter-submarine devices. The great majority are impractical. One suggestion concerns a scheme to create air bubbles near the ship and thereby divert the torpedo under a ship's bottom so that it will pass harmlessly by. Another planned to freeze the waters near the ship's hull so that the torpedo would strike ice and explode. Another concerns the distribution of heavy magnets along the bottom of the sea to attract the submarines and prevent them coming to the surface. Still another suggested constructing ships out of cotton so that the torpedoes would not explode on contact.

In telling his audience just how the world "evoluted," a union agitator said that if you would look into the "annuals" of history you would find that unionism was the first cause, founder and advocator of nearly all our progress, good laws and institutions. For instance, he said labor unions first started our system of public schools. He didn't give the number of the local, however. Perhaps some friend who is so fortunate as to possess a few "annuals" will be kind enough to put us straight on this point.

The Royal School of Mines has a fine record in the war. Of the British students in the school at the outbreak of war over 90% joined the services or accepted responsible war work, and many decorations and distinctions have been won, while casualties have been proportionately high.

Gerald Sherman, superintendent of the Mining Department of Phelps, Dodge & Co., told this one: At a miners' union meeting held at Bisbee at the time there was an attempt being made to unionize the camp, the question arose as to whether Mexicans admitted to the union should be allowed to work underground. One speaker opposed any such thought on the grounds of difference in economic equality of the whites and Mexicans. Waxing warm to his subject, he shouted: "How do they live? You all know. What do they wear? You all know. What do they eat?"—(Voice from back of hall) *"Chile Killarney and Torpedoes."*

Lincoln Steffens, who recently wrote the major part of the confiscatory constitution of Mexico, is now in Russia making an effort to render similar services to the new government there, says the Boston *News Bureau.* Senator La Follette, of Wisconsin, was largely responsible for the Steffens' trip to Russia. While La Follette has not been making much headway with his theories in the United States, he is trying to plant the germs of his ideas in the countries torn by revolution. He and Lincoln Steffens hold sympathetic views. If Steffens, himself a socialist, is able to help the socialists of Russia, he will do so. If the socialists should get into power, he will probably be authorized to write the Russian constitution, and if he plays true to form, it will be an exceedingly radical doctrine, providing for the dissipation of capital, and the removal of secure foundations from under foreign enterprises in Russia.

United Verde Copper Co. has decided to abandon its West Virginia charter in favor of one under the laws of Delaware. A new company, having similar name, will, therefore, be formed in the latter state to take over the assets and business of the existing concern. The company was originally incorporated in New York in 1883. In casting their votes in approval of the contemplated transfer, the stockholders cast what was probably a record vote; of 300,000 shares 299,948 shares were in favor with not a dissenting vote, according to the

Boston News Bureau. It is understood that less than 20 persons own the stock, with W. A. Clark controlling all but a few thousand shares. Adopting the policy of many latter-day corporations, shares of the United Verde Copper Co. of Delaware will have no par value and there will be 300,000 as at present. The existing stock, however, has a nominal par value of $10 and for some time has been paying monthly dividends of $1.50 a share.

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This is the story of a young British mining engineer: Capt. A. W. H. Dean graduated from the Royal School of Mines in 1913 and returned from abroad to join the army. He was attached to one of the tunneling companies, and in February, 1916, was promoted captain. He was decorated with the Military Cross in May, 1916, "For conspicuous gallantry. He rescued at great personal risk from a wrecked mine a N.C.O. and a man who had been entombed. He then went farther and found another man dead. Within five minutes of his return the whole gallery collapsed." On Jan. 11, 1917, he was awarded a bar to the Military Cross for the following service: "He blew a mine under the hostile front lines, which killed 280 of the enemy. He went at once over to the enemy front line with one servant, bombed a dugout, and took 3 officers and 46 men prisoners." Such surrenders of German soldiers to very inferior numbers were very frequent in France during 1916; the English captures alone, on the Somme, were about 40,000.

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A timely brochure, entitled "What a Geologist Can Do in War," has been prepared by R. A. F. Penrose, Jr., of Philadelphia, for the Geological Committee of the National Research Council, with the purpose of stating succintly the competency of the geologist in war service. A knowledge of geology, Mr. Penrose points out, can be made of use in many ways in time of war, not only to the army in camp, but to the army on the march and in battle. The subjects briefly touched upon are: Camps; trenches and tunnels; ground for artillery positions; roads; maps; long-distance observations; water supply; vibration effect, and "other qualities for usefulness," under which head is emphasized the geologist's general adaption to living conditions, both in civilization and out. His training has been to a great extent in the wilds among mountains, hills and plains; often without trails, where he has had to take his course by the blazes on the trees or from the stars, the moon or his compass, and often surrounded by hostile natives. He can fight, cook, withstand bad weather and discomfort and still keep on with scientific work; he has acquired the woodcraft of the trapper, together with the education of the scientist. Few other men possess this unusual combination of accomplishments.

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A writer in *Leslie's Weekly* tells the following interesting story of how John D. Ryan conducted the negotiations with F. A. Heinze that terminated the great copper mining war in Montana. Ryan opened negotiations with Heinze to buy all his properties in Montana. Heinze was anxious to sell, but wanted it arranged to create the impression he was merely effecting a compromise. Amalgamated was determined to eliminate Heinze and would entertain no negotiations which would leave him a loophole to cause further embarrassment. "Because of Heinze's strong objection to have it appear he had been bought out, and because of his insistence that it be represented as a merger, it was very hard to carry on negotiations that would remove Heinze root and branch," said Mr. Ryan. "The situation was relieved at times by a spice of humor. Heinze was mortally afraid the miners would learn he was preparing to sell out, as he was loudly promising to fight their battles if they would stand by him. He would never meet me except in the most out-of-the-way places. We never entered a building by the same door. He never came to my office and I never went to his. We would meet in offices of one of our lawyers or in rooms of friends. One of our most important sessions was held by appointment in Providence, R. I. From the very opening Heinze and I were friendly and, though many times we came near breaking off, we continued to treat in absolute good faith. He never once broke his word to me. After six months' negotiating we finally met one night and talked price from nine to three in the morning and settled things."

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The Old Gang

By Berton Braley

Yes, there was quite a crowd of us, and say, the camp was proud of us,
When we were young and husky there was none to beat our bunch,
Big bodied was the clan of us—six feet or more each man of us—
A lot of first-class miners, and each miner packed a punch.
We went on toots uproarious and tanked up something glorious,
Yet went to work of mornings feeling little worse for wear,
No other gang could drill at all, or shovel with our skill at all,
Yes, when it came to drinking and to mining, we were There!

Said Shea to all the rest of us, "The booze won't get the best of us,
We take a lot of likker, but we carry it so well."
Next morning, Shea, on duty, tripped, and in an empty chute he slipped,
I guess his eyes were bleary, or he never would have fell.
Then Dobbs and Moriarity both joined the great majority
(They'd seen the roof was shaky if it wasn't for the drink),
Their wives are on the county now—they sure could use the bounty now
Of all that whisky money that their husbands used to clink.

McWilliams shot Jim Harrigan when they went on a tear again,
And Scott he died of tremens at the finish of a bat,
For booze, it has a way with it, it gets you if you stay with it,
But we were shot to pieces 'fore we saw the truth of that.
Yes, once the town would boast of us, but likker got the most of us
(The mining supes don't want you with an alcoholic eye),
So, mooching drinks and quavering, along the streets we're wavering—
Say, haven't you two bits or so to feed a hungry guy?

Personals

Robert E. Cranston has been in New York.

T. H. France has gone to Salt Lake City for a stay of 3 months.

Edwin, E. Chase, and his son, of Denver, are in the southeast Missouri lead district.

Kirby Thomas has returned from the Notre Dame des Anges zinc district in Quebec.

H. H. Knox went to Mexico last week and is not expected back until the end of June.

J. W. McLaughlin is mine superintendent for the Cornwall Ore Bank Co., Cornwall, Penn.

Cleveland E. Dodge has been appointed a 2nd Lieutenant in the Engineer Officers Reserve Corps.

Henry M. Adkinson, general manager for the Empire Copper Co., Salt Lake City, was in New York last week.

A. E. Wells, of the Salt Lake City station of the Bureau of Mines, is studying smoke conditions at zinc plants in Kansas and Oklahoma.

Guilford Darby Scholl has been appointed superintendent of the electrolytic-zinc plant of the River Smelting and Refining Co. at Keokuk, Iowa.

Dr. Otto Sussman, who has been confined to the hospital for the past three weeks, is again at home and expects to return to his desk by next week.

Harrison Souder, formerly general superintendent for the Cornwall Ore Bank Co. Cornwall, Penn., has been appointed general manager for the company.

Captain Edwin C. Eckel, who returned from a professional trip to Argentina, on May 17, is now at the Reserve Officers Training Camp, at Fort Myer, Va.

A. W. Newberry sailed from Callao on May 16, for San Francisco. He will be located in that city hereafter, with headquarters at 805 Crocker Building.

M. L. Fuller, managing geologist of the Associated Geological Engineers, is conducting exploration work in West Virginia; C. T. Griswold has gone to New York.

C. W. Laurie, of the firm of Drucker & Laurie, is in Baltimore, Md., superintending the erection of a brass ash concentrating plant that is being erected by the firm.

B. Hochschild was elected chairman of the board of directors of the American Metal Co. at a recent meeting of the board. C. M. Loeb was elected president of the company.

H. G. Furguson, of the United States Geological Survey, has returned from an investigation of the tin deposit at Irish Creek, Va. The tin at this point occurs in quartz veins, none of which has been worked within twenty years.

B. M. Snyder has returned to Los Angeles from Montana, where he has been for the past month and will leave early in June for Pearce, Ariz., to take charge of construction work on the new mill of the Arizona Middlemarch Copper Co.

Capt. Elmer K. Hiles has been called into active service of the Fifth Regiment, Engineers Reserve, and has reported for duty. Captain Hiles is secretary of the Engineers' Society of Western Pennsylvania and began training for the service last summer at Plattsburg.

C. E. Siebenthal will leave Washington soon for an extended trip through the zinc mining and smelting districts. The principal object of the trip will be to secure information as to the changes which have taken place in smelting practice since the beginning of the war.

Benjamin Vallat, of Detroit has been named major of a battalion of engineers that is being organized at the Washington College of Mines. Major Vallat was formerly superintendent for the Newport Mining Co., on the Gogebic Range, and is now president of the Dominion Forge and Stamping Co.

Major-Gen. John W. Carson, C. B., of Montreal, has received the honor of being created a Knight Commander of the Bath by King George. In civil life Gen. Carson is a prominent financier and extensively interested in Cobalt and Porcupine mining enterprises. He is president of the Crown Reserve Mining Co.

William E. Hayes, Hartford, Conn., who left the employ of the Pratt & Whitney company nine years ago to take a position in the Washington Navy Yard and was afterward transferred to a high technical position in the navy department, has been named a superintendent of the Government armor plate plant to be erected at Charlestown, West Virginia.

E. F. Burchard has been appointed chief of the new section of the geology of iron and steel alloy metals that has been established by the directors of the United States Geological Survey to cover all geologic investigations of the ores of those metals. G. F. Loughlin will assist Mr. Burchard in the administration of the nonmetallic section of the division of mineral resources as geologist acting in charge.

F. Quattrone, chief engineer of the Italian State Rys., returned to the United States a few days ago. He left his post in New York last September, to become a member of the International Food Commission of London and to act as representative in that city for Mr. Bianchi, the Italian coal controller. Mr. Quattrone returns now to the United States as a special delegate of the Italian State Rys., to be attached to the Italian Embassy at Washington, and will have in charge the purchase and shipment of all materials to be contracted for by the Italian Government.

Obituary

John R. Champion, mine operator, died May 22 at his country home in Arvada, Colo., from cancer of the stomach. He had extensive experience in various districts but is probably best remembered as superintendent of the Yak Tunnel at Leadville, which responsible position he held for years, retiring only last fall on account of failing health. Mr. Champion, who was 60 years old, was born in Cornwall, England, and came to America when 15 years old. He began mining at Georgetown, Colo., in 1874; later moving to Leadville. His funeral in Denver, May 24, was conducted by the Masonic fraternity. He is survived by a widow and two daughters.

Flight Commander William T. Hall was killed in action on May 19. He was the only son of Fasa Hall, of the Standard Mining Exchange of Toronto, 24 years of age, and a mining engineer. Previous to his graduation he was employed with the Miller Lake, O'Brien and McIntyre mines in Northern Ontario, and afterwards occupied a position as mining engineer in Rancagua, Chile. He went to England in the spring of 1916 and obtained a commission as lieutenant in the Royal Flying Corps, being promoted in April to the rank of Flight Commander. No details as to how Commander Hall came by his death have been received.

John P. Edwards one of the pioneers of the American iron and steel business, who died at his home in Las Angeles, Calif., Apr. 17, at the age of 72 years, was one of the best-known men in the country during the earlier stages of the industries, and until recently was actively engaged in his work. In his younger days Mr. Edwards was closely associated with Capt. William Jones, and until the latter's death, their work was closely identified. During Mr. Edwards' incumbency of the general superintendency of the Cleveland Rolling Mill Co., he was largely instrumental in the development of the modern rod mill, and through his efforts the angle method of rail rolling and reduction was perfected. Aside from his activities in a supervisory capacity, it is through his work as a roll designer that Mr. Edwards will be best remembered. His intelligent application of the scientific principles of this branch of the industry made a deep impression. His oldest son, David J. Edwards, is now with the Texas Rolling Mill Co., Fort Worth, Tex., as consulting roll designer for its several plants.

Societies

Chicago Norske Club will be the center of an informal congress and reunion of American and Canadian engineers of Norwegian birth or descent, to be held at Chicago, Ill., Sept. 27, 28 and 29. Representatives from all sections of the country are expected to attend.

Engineers Society of Western Pennsylvania held its regular monthly meeting at the auditorium of the Union Arcade building on May 29. A paper on "An Efficient Gas Fired Boiler Installations" was read by J. C. Hobbs, assistant to the superintendent of power stations of the Duquesne Light Co., Pittsburgh, Penn.

American Institute of Mining Engineers, New York section, will hold a meeting on Wednesday, June 6, at the Machinery Club, 50 Church St. The meeting will be preceded by the annual meeting of the section, for the election of officers for the coming year, and for other business. Dinner will be served at 7 o'clock. Following the dinner, Mayor George H. Putnam will deliver a patriotic address.

American Gear Manufacturers Association—The recently organized American Gear Manufacturers Association held its first convention at the Hotel Schenley, Pittsburgh, Penn., on May 14 and 15. An interesting program was arranged and elaborate preparations made by the Pittsburgh members for entertaining the visiting manufacturers.

The Association has been organized for the purpose of developing, standardizing and improving all products of the gear industry. The officers of the Association are: F. W. Sinram, Van Dorn & Dutton Co., Cleveland, president; H. E. Eberhardt, Newark Gear Cutting Machine Co., Newark, N. J., vice president; F. D. Hamlin, Earle Gear & Machine Co., Philadelphia, secretary, and Frank Horsburgh, Horsburgh & Scott, Cleveland, treasurer.

American Association of Engineers held its third annual convention at Chicago, May 14 to 18. In order to provide the most democratic form of organization a committee consisting of Isham Randolph, W. H. Finley, R. C. Yeoman, Dean of Engineering, Valparaiso University, H. G. D. Nutting and T. H. Williams, was elected to prepare all proposed amendments to the national constitution for a mail ballot by all certified members of the association. The officers to be elected will also be submitted to all certified members in order that they signify their choice of candidates by mail. The following candidates were nominated: For National Director (one to be elected) R. C. Yeoman, Dean of Engineering, Valparaiso University, Valparaiso, Ind.; Wm. H. Sallwasser, secretary Gary Chapter; Instructor, School of American Bridge Co., Gary, Ind. For National Auditing Committee (three to be elected) Samuel Moreell, Jr., J. T. Mullin, and C. A. Gaenssien. The ballot will provide blank spaces wherein any other candidates name may be voted. The Convention adopted a resolution offering the National Headquarters as a recruiting station for the U. S. Army.

Industrial News

Davis Sulphur Ore Co. will move its office on May 5 to 65 Wall St., New York City.

Weiss Instrument Co. has moved into larger quarters at 1731 Arapahoe St., Denver, Colo.

Virginia Haloid Co., and A. J. Moxham have removed their offices to 19-25 W. 44th St., New York City.

Bradley, Bruff & Labarthe, designing engineers, have removed their offices to the Wells Fargo Building, 85 Second St., San Francisco.

United Smelting & Aluminum Co. has placed W. H. Allen, its Pittsburgh sales representative, with headquarters at 405 Fulton building.

The Associated Geological Engineers have removed from Pittsburgh to 3112 Equitable Bldg., New York. The Pittsburgh office will be discontinued.

W. A. Butchart has recently started a new plant of enlarged capacity for the manufacture of concentrating tables and allied apparatus at 1320 Eleventh St., Denver, Colo.

Smith, Libby & Eroe, Inc., announce that they have reorganized and will do business in the future under the name of Scott L. Libby & Co., Inc., 45 Broadway, New York, under the same management.

The Mine and Smelter Supply Co. has removed O. H. Johnson, who has had charge of The Marcy Mill Department in Salt Lake, together with his staff, to Denver, where they will make their headquarters in connection with the general offices of the company.

Buff & Buff Mfg. Co., Boston, Mass., makers of surveying instruments, has purchased the business of R. Seelig & Sons, of Chicago, an old firm in the same line, and will continue as a branch factory of the Buff & Buff Company. The establishment has been thoroughly modernized.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Aluminum Alloy and in Articles Made Therefrom. Albert W. Morris, Springfield, Mass. (U. S. No. 1,227,174; May 22, 1917.)

Crucible-Holder. Max W. Goldberg, Milwaukee, Wis. (U. S. No. 1,226,653; May 22, 1917.)

Dehydrator. Cyrus Robinson, Mount Vernon, N. Y., assignor to Metallurgical Engineering & Process Corporation. (U. S. No. 1,227,491; May 22, 1917.)

Electric Furnace—Furnace or Apparatus for Making Products Electrically and Means for Facilitating Discharge of Same. James Henry Reid, Newark, N. J., assignor to Patents Process Co. (U. S. No. 1,227,068; May 22, 1917.)

Electric Furnace—Furnace or Apparatus for Electrically Making Products and Means for Heating Discharging Products. James Henry Reid, Newark, N. J., assignor to Patents Process Co. (U. S. No. 1,227,069; May 22, 1917.)

Electric Induction-Furnace. Jacob Funck, Charlottenburg, Germany, assignor to The Grondal Kjellin Company, Ltd., London, England. (U. S. No. 1,226,764; May 22, 1917.)

Electric Welding. Spencer C. Cary, Brooklyn, N. Y. (U. S. No. 1,226,639; May 22, 1917.)

Furnace Discharge—Means for Promoting the Discharge of Molten Products from a Furnace or Other Apparatus. James Henry Reid, Newark, N. J., assignor to Patents Process Co. (U. S. No. 1,227,067; May 22, 1917.)

Ore Separator. Joseph S. Morrison, Wallport, Ore. (U. S. No. 1,227,552; May 22, 1917.)

Editorial Correspondence

SAN FRANCISCO—May 23

Quicksilver Production in California in 1916, according to the official returns received by the State Mining Bureau showed a large increase over 1915. The total production was 21,400 flasks of 75 lb., which was sold for $2,000,000 by the mine operators. Quotations varied from $300 per flask in February to an average of $75 in the last half of the year. The actual sales price realized by the producers was $93.50 per flask. Nearly one-half the total production came from the mines in San Benito County; about 20% from Santa Clara County and the remaining 30% from Lake, Napa, San Luis Obispo, Monterey, Solano and a few other counties. California in 1916 maintained its record of producing 70 to 80% of the quicksilver production of the United States and the indications are that the year 1917 will make a similar showing.

First All-Steel Mine-Rescue Car sent out by the U. S. Bureau of Mines arrived at its headquarters at Reno, Nev., on May 9 after a few days' stop at Salt Lake City, Utah. This car, designated as No. 1, is now in California. The initial visit in this state was at Kennett, where it remained until May 16 and then proceeded to Colfax. Owing to the fact that the railroad connection between Colfax and Grass Valley and Nevada City, Nevada County, is by narrow-gage road, the car was left at Colfax and three of the men and necessary equipment were sent to Grass Valley for first-aid and mine-rescue instruction to be given the men in the two mining districts, occupying 10 days. The car will then go back to Nevada, stopping at Tonopah, Goldfield and Aurora; thence to Ely in time to appear at the sectional meeting of the American Institute of Mining Engineers on June 23. Then back to Utah to spend the remainder of the summer and early fall in that state. Returning to California, after some additional training in Nevada, there will probably be an extended itinerary in this state. It is necessary for the car to work in Utah and Nevada during the summer months, owing to the high elevations in which the mines are situated and the lower temperatures prevailing. So in the future most of the California work will be done in the spring, fall and winter and the Utah and Nevada work in the late spring and summer. This is the first all-steel car put into service by the Bureau of Mines, but two others will soon be in commission, one at Butte, Mont., the other at Raton, N. M. The crew of No. 1 car is composed of Edward Steidle, mining engineer; J. B. Perry, foreman; Walter Pyne, first-aid man; Donald Cook, clerk; John Ward, cook. The sessions at Grass Valley were attended by State Mine Inspector Wolflin and Deputies Lowell, Gebb and Brown.

BUTTE—May 24

Keeping Engineers and Skilled Miners at the mines is becoming a serious problem for the mining companies of Montana. Already several hundred of the best men have volunteered their services in either the army or navy and the shortage, while not yet having much effect on the mining operations, is liable to make trouble later on. The predominance of the engineer in this war was commented upon at the recent banquet of the Montana Section meeting of the American Institute of Mining Engineers, at which President Philip N. Moore was the guest of honor. A large number of the younger mining engineers of the Butte district are preparing to enter Government service and Montana will send its full quota for this department, but the mining companies expect to have many of their men exempted on account of the great need for copper and zinc.

Anaconda's Expansion was only briefly discussed at the annual meeting last week; nevertheless the company is making gigantic strides in the acquirement of new properties, development of old ones and in improvements to the equipment of its present properties. Little is said by the local managements about what is being accomplished, but the earnings during the last year were the greatest in the company's history; with its note indebtedness of $16,000,000 wiped out, the interest on that saved, and ample funds on hand for all reasonable requirement, the company is in splendid shape to meet any emergencies. There are 1400 more stockholders on the books now than there were at this time last year. Within the next few weeks Frederick Laist, head of the metallurgical department of the Anaconda company, and William Wraith, head of the Tooele plant, will return from the properties of the Andes Copper Co., the subsidiary of the Anaconda in South America. It is probable that their recommendations will be submitted to the directors of the company at once and that large expenditures will be made at these properties in the near future. At its Butte mines the company is continually making improvements. During the last month the company has put into operation two modern and efficient plants. At the Pilot Butte mine, operated in conjunction with the Badger, a new hoist has been completed and is running; it is a Nordberg double-drum hoist capable of hoisting 2000 tons of ore per day from a 4000-ft. shaft. The Pilot Butte was taken over by the Anaconda company last year at a cost of a million and a quarter dollars. In addition to its reserves of copper ore, large bodies of zinc ores have been opened and preparations made to mine them. The estimated cost of the new equipment is $250,000. At the Alice mine, one of the zinc mines of the company in the Walkerville or northern Butte district, a new hoisting plant has also been installed lately. This plant has a capacity of 2000 tons of ore per day from the 1600-ft. level and will add materially to the zinc output of the company in the Butte district. The shortage of ore for the requirements of the zinc concentrator at Anaconda and the zinc refinery at Great Falls will be partly overcome, by the improvements at the Alice. Vice-President and Managing Director C. F. Kelley arrived in Butte the day after the annual meeting of the company and started on a trip of inspection of every department in Montana. He was accompanied by General Manager of Mines John Gillie and other company officials and it is probable that some extensive improvements will be authorized.

DENVER—May 24

Experiments on Rare-Metal Ores will soon be begun at Golden. Dr. R. B. Moore, head of the U. S. Bureau of Mines branch in Colorado, says that the remodeling and equipping of the School of Mines testing laboratory at Golden is practically complete and that the Bureau will soon be prepared to conduct treatment experiments upon rare-metal ores. Samples weighing from 50 to 500 lb. may be tested by fusion, roasting, smelting and acid, salt and alkaline leaching.

Driving of Camp Bird's Long Tunnel has been delayed on account of excessive flow of water. Pressure at face is such that water is thrown back into tunnel for many feet and water is knee-high over tracks. Branch is being driven at slight angle from main tunnel with hope of tapping water course and diverting flow from breast. Up to time this flow was struck tunnel had been driven at record speed through hard andesite breccia.

Second-Contact Exploration on Fryer Hill, Leadville, in the properties held by the United States Smelting, Refining and Mining Exploration Co., is being watched with much interest in this camp. For the last two months, the company has been sinking its Jamie Lee shaft from the level of the upper or first contact—in which all the early-day mining was done—with the object of exploiting the second contact that is presumed to be mineralized in the same manner as on Carbonate Hill. The shaft has been sunk 150 ft. and is about 680 ft. below the collar. At a depth of 115 ft. below the old level, a drift was driven far enough to intercept a flow of water that gave trouble in the shaft and a pump station has been excavated.

Shaft Sinking in Cripple Creek now constitutes most important part of this district's development work. At the Portland, sinking of No. 2 shaft from 1925-ft. level has been resumed and a raise is being lifted from 1000-ft. level of this shaft to connect with the Rose Nicol shaft; the Dillon shaft of Granite Gold Mining Co. is being sunk and is now 1675 ft. deep; Last Dollar shaft, now 1500 ft. deep, will be sunk by Catherine Gold Mining Co.; a new shaft is being sunk on the Lucky Corner ground of the Doctor-Jack Pot company; Lewellyn shaft of the Longfellow group is being sunk to depth of 800 ft. by the Excelsior company. The vertical shaft on the Ocean Wave claim of the Modoc Consolidated Mining Co. is being deepened by raises from the seventh and ninth levels of the Modoc incline.

WALLACE, IDAHO—May 24

Curtailment of Exploration has now to be faced in this camp. The situation in the Coeur d'Alene district indicates that high metal prices and high wages are not unmixed blessings. It would seem that the great profits being earned by the productive mines and the reasonable assurance that these will continue for a period of years would induce the greatest activity in the development of lead-silver and zinc mines, while as a matter of fact the tremendous prosperity of the mining industry operates against the opening up of new mines. For nearly a year and a half the mining companies have been sharing their prosperity with their employees in the way of increased wages until today every man who goes underground gets $4.75 per day, and of course under the stress of high metal prices every man that can be worked to advantage is on the payroll. This situation places the development company up against paying the same rate of wages or suspend operations, for why should a miner work for $3.50 or even $4 for the small company when he can get $4.75 from the big ones? In addition, the price of powder reached an almost prohibitive price so far as the small company is concerned, and this is true of all other material and supplies consumed in mining. Add to these the war. From the President down the line the people are being exhorted to economize, to plant "spuds," to wear plain clothes, to buy Liberty bonds, etc. So in the face of high wages, high cost of supplies and a persistent preachment to curtail expenses, what is a mining company going to do that depends upon small assessments every 60 or 90 days to keep the work going? It will have to quit, and that is what many of them have done in the Cœur d'Alene district.

KELLOGG, IDAHO—May 25

Zinc Plant for Bunker Hill & Sullivan will be erected for treatment of local and custom ores. Pres. F. W. Bradley today wired the "Journal" as follows: "Replying to your telegram, we have decided to add, after the lead smeltery is in operation, an electrolytic zinc plant having an output of 10 tons metallic zinc per day, to be secured from water- and flotation-concentration work on local mixed zinc-lead custom ores."

JEROME, ARIZ.—May 26

Miners' Strike in Jerome resulted in the stoppage of production on May 25. Not only were the two leading mines—United Verde and United Verde Extension—affected, but also all the developing operations. The miners demanded the Miami scale, the closed shop, the checking system and a grievance committee. The principal companies granted the wage scale asked but will remain adamant regarding the closed shop and other questions. About 200 of the 1100 employees of the United Verde are reported to be at work and it is likely that gradual resumption will be attempted by the other companies without recognition of the "union features" of the miners' demands.

PHŒNIX, ARIZ.—May 17

Improving Alkali Land with sulphuric acid has been tried with apparent success in other Western states and opens up possibilities for utilizing the sulphuric acid which Arizona smelting plants are capable of producing. It is stated that "the shortage of fertilizers, the immense areas of unimproved alkali land and the possible production of sulphuric acid as a byproduct of smelting operations suggest experiments on the use of sulphuric acid as a means of redeeming alkaline soil, which has been done with some degree of success in California." Assistance along this line is asked of the Arizona Agricultural Experiment Station. Only lately the Calumet & Arizona initiated production of sulphuric acid on a large scale at its Douglas smeltery; this production, however, was intended primarily for the copper-leaching operations of its subsidiary in the Ajo district.

HOUGHTON, MICH.—May 25

Storage-Battery Locomotive order of the Calumet & Hecla continues to be a topic of interest among the Lake copper operators. As stated last week, the company has recently placed an order for 32 storage-battery locomotives of the Goodman articulated type. These, with the one already in use at No. 15 shaft, and the five trolley locomotives at the Allouez, make a total of 38 locomotives to be installed by the C. & H. interests. The 38 locomotives are expected to do the work of about 250 men and will release a considerable proportion of these men for other work. Mechanical haulage is being introduced by the Calumet & Hecla and other companies in this district because of the almost utter impossibility of securing a sufficient number of men for the ordinary labor of tramming or the loading and pushing of cars from stopes to shafts. The Copper Range company uses a trolley system, with which satisfactory results are obtained, although it is said to be somewhat more costly in upkeep than the battery system. Franklin, Tamarack, Quincy and some of the other mines are using compressed air-driven rope haulage for handling the tram cars and the Franklin has also installed, at one level, a motor-driven rope-haulage system that is giving very satisfactory results. The rope-haulage system works well in straight levels or drifts but the trolley or battery-propelled locomotives are better in the wind-

ing ways. Conditions at the several mines must govern, of course, when the installation of a mechanical haulage system is contemplated. Hancock is experimenting with a Whitcomb battery locomotive underground. Both Wolverine and Mohawk are contemplating installing mechanical haulage and possibly will install the battery-driven type. Mules have been tried for tramming work in some of the Lake copper mines but not with any great success. The Ahmeek has a few mules underground but the Calumet & Hecla has discarded the system altogether.

WASHINGTON, D. C.—May 26

A Platinum Survey will be made by the U. S. Geological Survey to ascertain the amount of platinum on hand in the United States. The work will be in charge of J. M. Hill, a geologist of the Survey, who has specialized on platinum for several years. Inquiries will be sent to all refiners and dealers in the metal, to dental manufacturers, manufacturing jewelers and to certain manufacturing chemists, who will be requested to report the amount of their stock of crude platinum and the amount of its platinum content; the amount of crude platinum in process of refining; the amount of platinum ingot on hand; of platinum sheet; of platinum wire; of platinum-iridium ingot, sheet and wire; of the platinum content in sponge, gauze and chloride and in all kinds of platinum scrap. With this information from the 3000 persons interested in some form of the platinum industry, the Government will be able to act much more intelligently. From such information as has been obtained by the Survey, however, it is believed that the stock of metal in this country will be found sufficiently large to satisfy immediate requirements and it is thought that further supplies can be secured from Russia if the demand should become acute. Representative Longworth recently introduced a bill providing a practically prohibitive tax (250%) on platinum sold for jewelry purposes.

JOPLIN, MO.—May 26

Openpit Mining by Steam Shovel is planned by the Missouri Zinc Mines Co. at the old Quick Seven mine at Neck City. It is now mining by openpit successfully but plans consolidation of the 1909 and Texmo mills into 1000-ton plant. The property has become one of the profitable ones of district.

First-Aid Field Meet will be held at Webb City during the latter part of June. Dr. W. A. Lynott, until recently with U. S. Bureau of Mines, now employed by local operators' safety and sanitation association, is in charge of the preparations. Assurance of entrance of about 25 teams has already been secured and others will come in. It is hoped to have 35 teams competing.

Production Record for 500-ton Mill in this district is claimed by the Blue Mound Mining Co., for its plant, situated in Kansas, just north of the Picher, Okla., mines. This plant is now turning out 270 tons concentrates weekly. For the first 11 weeks after it began operation, it averaged 250 tons, which is better than the present average of the Montreal, the best Oklahoma producer with the exception of the Picher's big Netta mill. Recovery at the Blue Mound is about 10%; of the output, 90% is blende and 10% lead. Operations are carried on at 203 ft., and a deeper ore run, believed to be richer, at 265 ft. has not been touched as yet.

ST. LOUIS—May 24

Southeast Missouri Operators Are Optimistic as to the future of lead, and are using every available means of increasing the output for 1917 above that of 1916. From all indications, the desired production seems in a fair way of being accomplished. The mines and mills of the Federal, Boston-Elvins, National, Desloge, Doe Run and St. Joseph lead companies are working full crews, and are forcing the output to the uttermost. St. Joseph, Doe Run, Federal and National are adding to and enlarging their mills, so as to handle the increased output from the mines. After a 50c. bonus was declared two months ago, the companies did away with the extra bonus check, and this increase is now carried in the regular salary accounts. Most of the companies recently gave each of their employees a plowed lot of approximately one-quarter of an acre, to be planted in vegetables. The new Federal mill at Elvins was forced to shut down May 11 for a few days on account of no power. The power plant's boilers gave way and had to be replaced, during which time only enough power was available to keep the old mill running at Flat River.

In Fredericktown Section the mining of lead, nickel, cobalt, copper and tungsten is increasing with warm weather as most of the mines are compelled to curtail operations in the winter on account of bad roads. The Catherine mine, four miles west of Fredericktown, is under lease to the Federal Lead Co. The Silvermines property, eight miles west of Fredericktown, is now controlled by an Eastern organization. Originally mined for silver, for many years, it has suddenly become a tungsten producer. Wolframite is the important mineral, occurring in quartz veins in granite. The "run-of-mine" rock is hand sorted, then sent to crushers, stamps, and finally tabled. The Missouri Cobalt Co., Ltd., a Canadian company, is operating just south of the town. R. F. Taylor is general superintendent and H. Cox is in charge of the new construction. The ores are sulphides and carbonates of lead, sulphides and carbonates of copper, nickel (siegenite) cobalt and silver, occurring in Cambrian limestone. The mill is now being remodeled to treat the complex ores. The flow sheet will probably consist of ball mills, Deister-Overstrom tables, a flotation plant, also roasters and reverberatory furnaces. A leaching system for the matte will probably be used, and the copper, nickel and cobalt will be separated chemically by a process not made known to the public.

TORONTO—May 24

Suspension of Assessment work on mining claims was asked by the Temiskaming Associated Boards of Trade at their annual meeting at Haileybury, Ont., on May 19. It was decided to appeal to the provincial mines department for the suspension of all assessment work on claims recorded prior to Apr. 1, 1917. The object of this is to release needed labor to maintain production in the operating mines and for agricultural work. Most of the prospectors are experienced and capable miners.

Railroad to Kirkland Lake is now assured at an early date. The Ontario government has appropriated $125,000 for the construction of the branch line of the Temiskaming & Northern Ontario Ry. to Kirkland Lake. Surveys are already being made and it is expected that work will be started this summer. The country is a comparatively easy one to build a line through, so that construction should be completed in a short time. The line will be about seven miles long.

The Mining News

ARIZONA

Cochise County

CALUMET & ARIZONA (Douglas)—Production of company in April was 5,900,000 lb. blister copper.

ARIZONA MIDDLEMARCH COPPER (Pearce)—Concentrating mill to be built at once at this property under direction of B. M. Snyder.

Graham County

ATLAS COPPER (Safford)—Extracting surface ore from three open pits; inclined haulage operated by air hoists; material rough sorted in pits which have approximate depth of 30 ft. About 10 tons per day being hauled by wagon to Safford. Unwatering 330-ft. main shaft to check drill-hole results of former owners. Installing No. 23 Star traction drill to explore further the known mineralized area, at present about 50 acres. R. J. Young, superintendent.

Mohave County

TOM REED (Oatman)—The remodeled 300-ton mill has had its preliminary run and was to be in regular operation before June 1.

GOLD BACK MINING CO. (Chloride)—Drift on 150-ft. level opened 7 ft. of ore carrying gold, silver, copper, lead and zinc. Jack Lytle, superintendent.

DIANA (Chloride)—Lately installed $4000 worth of new machinery and started shaft 1000 ft. east of old prospecting shaft; two shifts at work. George F. Beveridge, in charge.

WEST STAR (Chloride)—Bonded by J. E. Carter. Headframe erected and when hoist—purchased in Oatman—arrives, present 60-ft. shaft will be sunk to the 200.

PAYROLL (Chloride)—Taken over recently under 10 years' lease by L. F. Martin and associates of Calexico, Calif. Development commenced May 1 on 400-ft. level. A. W. Henning, superintendent.

TELLURIDE & CHLORIDE LEASING, MINING AND MILLING (Chloride)—This company, developing the old Schenectady, let contract for sinking shaft from 175-ft. level to the 400; following dip of vein and at the bottom, 225 ft., some good ore is being encountered. H. L. Heath, superintendent.

TUCKAHOE (Chloride)—Being reopened under lease and bond by J. E. Carter, of Colorado. Gasoline hoist purchased. Headframe erected and preparing to sink new shaft, the old one being badly caved. Mr. Carter supervising work.

IXL CONSOLIDATED MINES CO. (Chloride)—George F. Beveridge, L. F. Martin and associates have taken over the IXL adjoining Wrigley Sulphides Co. property. Will commence work about June 1. Mine formerly worked to the 157-ft. level. E. Martin Thorniley, of Chloride, will have charge.

MERRIMAC (Chloride)—Bonded to J. C. Rankin, who with 9-hp. Fairbanks-Morse hoist, is sinking new shaft several hundred feet east of old one. The Merrimac was operated years ago and an attempt made to mill the ore in the old plant which was not successful; mill still standing. J. P. Ryan, superintendent.

UNITED EASTERN (Oatman)—In first four months mill treated 22,473 tons of ore; gross value $504,170; profits $331,000. Gross value per ton averaged $22.21; working costs and losses $8.23; average net profits $13.47. Working costs and losses in April were only $7.49. Mill now treating an average of about 235 tons daily. Ore being mined from three separate levels; shaft being sunk from present level at 790 ft. to 1190-ft. level, where further lateral exploration will be made.

Pinal County

RAY CONSOLIDATED (Ray)—April copper output 7,902,724 lb.

PICKET POST GOLD MINING (Superior)—Shaft down 100 ft.; drift in 55 ft., 28 of which is in ore.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Annual report shows total income last year $97,779; total cost, $127,739, which includes tailing-dam repairs, equipment and strike expenses. Development indicates that operating expenses can now be paid from ore above the 2690 level and that a profit may be expected from ore below the 3200 level. Will keep full 40 stamps dropping regularly.

Calaveras County

UTICA-GOLD CLIFF (Angels Camp)—Both mines producing ore and keeping the Stickels and the Gold Cliff mills running. Good-grade ore in lower levels of Gold Cliff.

ESPERANZA (Mokelumne Hill)—F. M. Baker, of Carson, Nev., has optioned this mine on Mokelumne River; idle for 17 years. Developed by 1300-ft. shaft and levels at 100-ft. points. S. L. Davidson is owner.

Del Norte County

AMERICAN EXPLORATION CO. (Crescent City)—Will operate this chrome mine on French Hill on royalty. Owned by H. H. Morrell.

PRESTON PEAK (Waldo, Ore.)—This copper mine, under lease by Dr. J. F. Reddy, of Grants Pass. Eastern company may take it over. Ore contains gold as well as copper.

TYSEN (Crescent City)—Shipments will soon be made from this chrome mine, owned by Tysen Estate, 18 miles north and 3½ miles from stage road. Ore to be shipped by steamer to San Francisco; 400 tons ready. John Hampshire, Grants Pass, Ore., of the American Exploration Co. staff, is in charge.

Kern County

BUTTE (Randsburg)—Mine and 5-stamp mill in active operation; 10 men employed. Good ore extracted from 215-ft. level.

BLACKHAWK (Randsburg)—New hoist installed and ore going to mill daily. Under management of the Yellow Aster.

YELLOW ASTER (Randsburg)—Dismantling old 30-stamp mill to make dump room. Mill was installed in 1898 and ran continuously till 1913; was first reduction plant on the mine. Ore milled in early days ran $30 a ton. Present 100-stamp mill treats ore running about $4 per ton. Extensive stripping in advance of the east face of the gloryhole contemplated. At annual meeting held at Los Angeles, Albert Ancker was elected president; Dr. R. L. Burcham, secretary; J. H. Farrell, managing director.

Lake County

SULPHUR BANKS (Lakeport)—Reported that this quicksilver mine is to be reopened, after being idle for about 20 years.

Mono County

AMIGO & McLEAN (Masonic)—Shipments of molybdenite ore started for Eastern market. Several new claims located near the original discovery.

MASONIC GOLD MINING AND REDUCTION CO. (Masonic)—Driving tunnel to intersect main orebody exposed in adjoining property. L. J. Cockburn, general manager.

PITTSBURG-LIBERTY (Masonic) — Reported that Conway & Fredericks, operating lease and option, disclosed 2-ft. vein of high-grade ore. Have other good shipping ore. Crosscutting for main vein.

Nevada County

ALLISON RANCH (Grass Valley)—High-grade ore reported. Pumps are making good headway unwatering lower levels. Construction of new milling plant progressing.

COLUMBIA (Washington) — Additional 10 stamps to be installed. The 300-ft. winze from end of tunnel will be deepened to 500 ft. This in Ocean Star ground; both mines operated by the same company. E. C. Klinker, manager.

Placer County

RUBLIN QUARTZ (Auburn)—Company has contracted to sell claims in Last Chance mining district to W. T. Watson; price approximates $40,000, payable in two years.

LIME KILN CHROME (Newcastle)—R. H. Farmer is enlarging loading bunkers. Employs 35 men; to be increased to 50 as soon as boarding house can be fitted up. Ore hauled to Newcastle station in motor trucks.

FARMER & SWANTON (Newcastle)—Enlarged bunkers completed. Ore crushed at Union Chrome Co. sampling works, which will be equipped with electrically driven crusher by Farmer & Swanton. Will also install concentrator for low-grade chrome ore.

Plumas County

GOLD NUGGET, worth about $240, obtained in cleanup by Byron Turner who is operating placer ground by "shooter" method on Squirrel Creek.

OLD RED (Quincy)—Mine on middle fork Feather River. Ore decomposed quartz and ochre, not amenable to amalgamation. A. A. Slaback, of Santa Ana, preparing to install special concentration process.

San Bernardino County

MOJAVE ANNEX TUNGSTEN MINING (Barnwell)—This company building 20-ton mill, hauling equipment from Brant station, to property in New York Mountains; in addition to tungsten vein, has opened copper-zinc orebody. Company also has tungsten mine in Clark's Mountain district on Nevada side of line, reached from Roach station. Joseph B. Evans, president, 211 National Bank of Arizona Bldg., Phoenix, Ariz.

Shasta County

DONKEY (Ingot)—Reported that development under option by the Mammoth Copper Mining Co. has been abandoned. Situated near the Afterthought mine and has been considered good copper prospect.

BELL COW (Redding)—Gold property situated on Arbuckle Mountain, 40 miles southwest of Redding, optioned by C. L. Wilson. After constructing 2-mile road, development will be started. Frank A. Green and T. P. Ames are owners.

Tehama County

TEDOC MINING CO. (San Francisco)—Chrome claims in western part of county reported purchased of M. G. Gill of Redding. Company also negotiated for other claims, making total of 20 on Tedoc Mountain. New wagon or truck road will be built from mines to Red Bluff. Extensive development contemplated. Agard & Stewart, of San Francisco, are managers.

Trinity County

MONARCH (Sonora)—Mill being installed for this gravel mine on Stanislaus River. Theodore De Mauris, superintendent.

ACCIDENT GOLD MINING CO (French Gulch)—Nineteen claims on Trinity Mountain including the Sybil mine reported sold to the Shasta Hills Mining Co.; 10 men employed in development.

LA GRANGE (Weaverville)—Work started on Dalton Creek, five miles south. It is believed company will mine some of the Union Hill ground and may acquire entire property.

Yuba County

EASY MONEY (Challenge)—Strike of good ore reported and 5-stamp mill contemplated. T. J. Henderson and associates are developing.

COLORADO

Clear Creek County

PAY ROCK (Silver Plume)—This mine, a large silver producer of early days, will be reopened.

SILVER PLUME CONSOLIDATED (Silver Plume)—Acquired control of Buxton group of 10 claims, Florence group of three claims, both near town of Silver Plume, and Diamond Joe group of seven claims at head of Virginia Canyon. Two former are silver bearing and latter gold-copper. Work started on Florence group and high-grade silver ore shipped.

WYOMING VALLEY (Idaho Springs)—Contract for 100-ft. crosscut let.

EMPRESS (Freeland)—This group to be operated by lessees. Owned by Boulder Tungsten Co.

JACKSON MILL (Idaho Springs)—New machinery and flotation process will be installed. Lately operated by lessees on ore from Edgar mine of Big Five company.

COLORADO CENTRAL (Georgetown)—Ocean Wave level being retimbered. Large shoot milling-grade zinc ore left by former operators will be worked through this level and treated in milling plant.

Dolores County

SILVER SWAN (Rico)—Several cars good-grade lead-zinc ore shipped recently.

HIAWATHA (Rico)—Lessees Hay & Herron shipping high-grade silver ore. Work done through Group tunnel.

ESPERANZA (Rico)—Crosscut tunnel being driven to find extension of oreshoot opened in Puzzle mine. Several small veins cut.

RESOLUTE MINING CO. (Rico)—Steady production of lead-zinc ore being made from New York mine on Newman Hill. Operations to be increased.

Hinsdale County

INDIANA (Lake City)—Development resumed on this Gold Hill property.

GOLDEN FLEECE (Lake City)—New machinery being installed in milling plant.

DOLLY VARDEN (Lake City)—Taken over by Eastern men and will be reopened. Former copper-silver producer.

HIDDEN TREASURE (Lake City)—Production being made and systematic development in progress. Examined recently by Denver engineers.

Lake County

OZARK (Leadville)—Large shoot high-grade gold ore developed recently. Several shipments made.

DENVER CITY (Leadville)—Lessees picked up extension of main shoot; outputting lead-zinc ore assaying 30% in combined sulphides.

M. E. C. (Leadville)—Lessees doing exploratory work on 330-ft. level to open continuation of shoot on adjoining Coronado of the Down Town Mines Co.

PONSARDIN (Leadville)—Production stopped until shaft is retimbered to 140-ft. level. Much lead-zinc ore being developed, and expected to exceed last year's production.

FANNY RAWLINS (Leadville)—This property on Breece Hill struck rich ore in the Kyle winze at 800 ft.. From same high-grade ore was extracted through St. Louis tunnel two years ago.

VALLEY (Leadville)—A number of small veins being opened in development work. Under direction of Warren F. Page, the Silver Spoon, in Big Evans Gulch, is driving drift north from bottom of shaft to cut under Valley tunnel.

IBEX (Leadville)—Burton lease on 10th level of Ibex No. 4 uncovered rich gold vein; one large piece of nearly pure gold weighing 3 lb. recently extracted; stated that 18 lb. of metallics has been secured to date. Also shipping 300 tons of good-grade gold ore monthly.

DOLD MINING (Leadville)—Contrary to expectations, the Northern shaft has been opened to bottom without encountering any obstacles; idle 15 years and was supposed to have caved at several points. Preparing to do extensive underground development. New 82-hp. electric hoist will be installed and shaft sunk to pierce the parting quartzite.

Mesa County

UTE SHALE OIL CO. (Debeque)—Incorporated recently by J. W. Richards, P. W. Bowman and D. D. Potter; plant will be built for distilling oil from shales of Mesa and Garfield Counties.

Ouray County

CONGRESS (Ironton)—Sinking shaft 50 ft. from fourth level completed. Shipments will begin as soon as railroad is opened.

NEW DREDGING PROJECT launched to work bed of Uncompahgre River. Chicago syndicate has secured options on all placer ground on both sides of river from town of Ridgway to Corb Creek, seven miles.

MINERAL FARM (Ouray)—This property just south of town will resume under management of C. R. Wilfley. Mill equipped with Cascade system of flotation, given thorough try-out last fall. Ore consists of sulphides of lead, zinc, iron and copper, with some gold and silver, in gangue of quartz and barite.

Pitkin County

MIDNIGHT (Aspen)—Dreadnought drills will be installed and rate of driving tunnel increased.

Rio Blanco County

DENVER CHEMICAL PRODUCTS CO. reported to have purchased uranium-bearing claims in Coal Creek section, near Meeker, for $10,000. Ores stated to be of as good grade as those in Paradox Valley.

San Juan County

PRECIOUS METALS (Ironton)—Work resumed. Discoveries of good-grade lead ore made.

TELESCOPE MINING AND MILLING (Silverton)—Reorganization of Crater company. Property consists of 21 claims; main vein developed by adits. New machinery will be installed and production started.

LACKAWANNA MINING AND REDUCTION (Silverton)—Recently incorporated; has been working Lackawanna mine under lease and bond for past year. Both milling and smelting ore—lead, copper and silver—being produced.

San Miguel County

BALLARD (Telluride)—Anderson & Lacey Leasing Co., operating this property, have started 10 stamps at Weller mill.

JURICH MINING & LEASING CO. (Ophir)—This company, operating Butterfly mine, has mill bins full of ore and is now repairing pipe line preparatory to running 20 stamps at mill.

Summit County

ST. JOHN (Montezuma)—Operations will be resumed this summer.

KING SOLOMON (Frisco)—Development resumed through tunnel level on No. 11 vein.

CREST MINING CO. (Breckenridge)—Recently purchased Carbonate group; work started.

WASHINGTON (Breckenridge)—Lessees ready to ship high-grade lead ore, but condition of roads prevents at present.

MICHIGAN (Kokomo)—Night hauling being done on account of spring breakup of roads. Lead ore being shipped.

IRON MASK (Breckenridge)—Tunnel level being reopened by lessees. Considerable manganese ore and low-grade sulphide ore left in old workings.

JESSIE (Breckenridge)—Crew of 20 men employed on development. Mine recently examined by Denver mining engineer with purpose of outlining new development work, especially advisability of sinking shaft deeper and making alterations in milling plant.

Teller County

REX (Cripple Creek)—Mine and mill now being worked by lessees. New electric hoist installed.

RAMONA (Cripple Creek)—This Bull Hill property, owned by V. Z. Reed Investment Co., of Denver, leased. Work will commence at once.

MOUNTAIN BEAUTY (Cripple Creek)—Lessees, operating through specimen shaft of Stratton Estate, shipping 2-oz. gold ore from 500- and 600-ft. levels.

JERRY JOHNSON (Cripple Creek)—Streak of high-grade gold ore opened by Caley lease on 650-ft. level. Cripple Creek Deep Leasing Co. driving 950-ft. level to cut same shoot.

FOREST QUEEN (Cripple Creek)—Being worked under lease by Edwin Gaylord. Shaft enlarged to 100-ft. level, making it same size as below, and retimbered to 600-ft. level. New machinery installed. Milling-grade ore now being produced.

MICHIGAN

Copper

SUPERIOR (Houghton)—Shipping only 450 to 550 tons daily to mills; a 10% decrease this month.

ALLOUEZ (Allouez)—Handling only 1800 to 1900 tons, compared with normal average of 2100 tons. More men needed.

NEW BALTIC (Houghton)—Resumed hoisting after spending six weeks in cutting shaft back into footwall of lode.

QUINCY (Hancock)—Still in the rich mass copper encountered at incline depth of 6000 ft. in the west lode. Delay in shipment of new hoist equipment.

AHMEEK (Ahmeek)—Stamping 4000 tons daily and occasionally above these figures. Capacity nearly 5000 tons, but more men are needed. Repairs at No. 2 shaft completed.

NEW ARCADIAN (Houghton)—Breaking good ore at three lowest levels. Stockpile underground about cleaned up by mill shipments. Foundations laid for new compressor.

HOUGHTON (Houghton)—Running into rich ground on eighth level, where it was opened from winze carried down from sixth level. Also in good ground on sixth level.

MASS (Mass)—Output 800 to 900 tons, compared with normal of 1000 to 1100 tons. Pushing openings in the Butler lode; explorations in Evergreen series continuing.

ISLE ROYALE (Houghton)—Shipping about 3150 tons daily. No. 2 shaft flattened to conform to dip of Portage lode, doing away with expense of crosscutting thereto. Still sinking in three of its shafts.

FRANKLIN (Demmon)—Increasing daily rock output; now handling 1000 to 1200 tons. No. 2 shaft cleaned out to below 13th level and skip installed. Mill handling South Lake and New Arcadian ore.

SOUTH LAKE (Houghton)—During first three weeks of May, sent 70 cars of rock to Franklin mill. Recovery averaging 16 lb. per ton.

MOHAWK (Mohawk)—May output will be greater than in April; averaging 70 cars daily to the mill. Rock of good grade throughout mine; richest from No. 6 shaft running up to 30 lb. per ton.

NORTH LAKE (Lake Mine)—Still in the sandstone bed, about 1100 ft. from shaft in southeast drift; expected soon to pass into trap. Crosscut, which is looking for the Evergreen series, is in about 1100 ft. and in trap.

FEDERAL SYNDICATE COPPER CO. (Calumet)—This company, organized last autumn by Michigan, Minnesota and Wisconsin men, capital $1,000,000, par value $1, nonassessable, will begin drilling Kearsarge conglomerate, two miles southeast of Phœnix shaft of Keweenaw Copper Co. in Sec. 33.

OSCEOLA (Osceola)—Increasing production at the old mines. The Kearsarge branches producing 75 cars of ore daily. The two long drifts into La Salle property are opening rock richer than anything the La Salle is mining. It is understood La Salle will eventually put down a shaft in this territory.

Iron

NORTH LAKE (Ishpeming)—Third shaft to be sunk west of present shafts. Churn drill used to test formation to find solid ground.

MILLIE (Iron Mountain)—Leased to Pewabic Mining Co. Ore will be taken out through Walpole mine, owned by company. About 40,000 tons will be shipped this season.

ATHENS (Negaunee)—Shaft has been bottomed. Deepest iron-ore shaft in the country. Station being cut at depth below 2400 ft., where concrete pockets will be put in. Drifting will be under way soon. Ore should be coming to surface some time in June.

MISSOURI

Joplin District

T. A. BALDWIN (Joplin)—Purchased Barnett lead mine east of Duenweg and has started new shaft.

CAROLINA (Baxter, Kan.)—Reports good strikes in drilling campaign on Moore land, southwest of Baxter.

JACK RABBIT (Quapaw, Okla.)—Opening new mine at Sunnyside, north old Red Eagle. Drillings indicate orebody at 65 ft.

LUCKY EXTENSION (Century, Okla.)—Has started shaft and plans erection of mill on lease south of Century. Washington County men interested.

INSPIRATION LEAD AND ZINC (Baxter, Kan.)—Let contract for 400-ton mill on Wilbur land, north of Blue Mound, Kan. Amos Gipson, Joplin, president.

JOHNSON & CO. (Joplin)—Just paid $10,000 for 10-acre lease on Rose land, south of Joplin. Will sink old shaft to deeper level and mine silicate run shown by drilling.

LUCKY ELEVEN (Joplin)—Mine southwest of Carthage sold to I. P. Jones, Fayetteville, Ark., for $30,000. New property with one shaft in ore; no equipment except whim. Good drill holes.

MONTANA

Jefferson County

GOLDEN CURRY (Elkhorn)—This company's Sour Dough group reported optioned to the Guggenheim interests. About 8000 ft. of tunnel and shafts; ore contains copper, gold and silver.

Lewis and Clark County

PORPHYRY DIKE GOLD (Rimini)—New crushing plant planned; mill tailings, it is reported, will be pumped over ridge to avoid damage to Helena water supply. James Breen, of Helena, general manager.

Silver Bow County

BUTTE & ZENITH CITY (Butte)—Shaft now down 1240 ft. Will cut station at 1500 ft.

GREAT BUTTE (Butte)—Station cut at 1500-ft. level of Calumet shaft and electric pump is being installed. Company stated to have funds assured for about 2500 ft. of lateral development.

NORTH BUTTE (Butte)—Company has decided to sink its new east-side shaft on the Sarsfield claim. Shaft will be 1000 ft. deep; will sink 600 ft. from Sarsfield tunnel and drive raise to prospect from this shaft for Tropic vein of the Anaconda company and Motheral vein of the East Butte.

ANACONDA (Butte)—High Ore mine will resume soon; Tramway shaft not yet operating, but ore is being removed through the Pennsylvania where ore bins are being enlarged. Modoc fire is now supposed to be extinguished, but water is still being played on the burned timbers. Bonanza shaft now down nearly 600 ft.; to be sunk 400 ft. farther.

NEVADA

Elko County

LYNN BIG SIX (Carlin)—Has recently started mill consisting of crusher, Hardinge mill and amalgamating plates; ore free milling. W. W. Ruby, superintendent.

Esmeralda County

KEWANAS (Goldfield)—Stated that south drift from east crosscut has for last 100 ft. exposed from 2 to 4 ft. of good ore.

BLUE BULL (Goldfield)—For several months has been running crosscut east on 700-ft. level of Hat shaft; several veins cut but no payable ore encountered. Company plans to resume work on ground, formerly under lease to Simmerone company, from which some ore was shipped.

Eureka County

UNION MINES CO. (Union Mines)—This Philadelphia company has combined the Rye Grass, Flinn and other silver-lead properties on Union Hill, 34 miles south of Palisades and 9½ miles from the railroad. William P. Fairman, of Fairman & Co., 742 Drexel Bldg., Philadelphia, president; Sen. L. R. Thatcher, of Nevada, general manager.

Nye County

TONOPAH ORE PRODUCTION for week ended May 19 was 8750 tons, valued at $161,875, compared with 9468 tons for week previous. Producers were: Tonopah Belmont, 2582 tons; Tonopah Extension, 2380; Tonopah Mining, 1700; West End, 976; Jim Butler, 700; Rescue-Eula, 193; Cash Boy, 60; Montana Tonopah lessees, 159 tons.

JIM BUTLER (Tonopah)—April profit amounted to $48,590 from treatment of 2685 tons shipped to the Belmont plant at Millers.

ORIZABA (Millers)—Stated that control has been taken by General Mines Co., of Reno, which will do extensive development.

TONOPAH BELMONT (Tonopah)—Net profit for April was $83,250 from treatment of 11,745 dry tons ore. Bullion production was 1,948,677 oz. gold and 184,568 oz. silver.

TONOPAH MINING (Tonopah)—Profit for April was $93,235 from 8395 dry tons, having average value of $21.45 per ton. Bullion production was 181,955 oz., valued at $170,375.

White Pine County

NEVADA CONSOLIDATED (McGill)—Copper output in April 6,727,192 lb.

NEW MEXICO

Grant County

CHINO (Hurley)—Copper output in April 6,368,874 lb.

CARLISLE CONSOLIDATED MINING (Duncan, Ariz.)—Newly incorporated by Henry Hill and Reese Webster, of Clifton, Ariz., and David Gough to develop an area between the Carlisle and the Progress mines.

OREGON

Josephine County

QUEEN OF BRONZE (Takilma)—Continues to ship high-grade copper ore. Working 65 men. Roy Clark, manager.

PARSONS (Grants Pass)—First car copper ore shipped from this Pickett Creek group to Tacoma smeltery. D. R. Morrison in charge.

LILY (Takilma)—Adjoins Waldo mine on south. Under option by M. A. Delano, of Grants Pass. Will begin shipping copper ore in few days.

LOGAN-SIMMONS (Waldo)—Another clean-up at this placer yielded several thousand dollars worth of gold besides some platinum. G. E. Easterly is prospecting property; owned by Mrs. Jane Simmons, of Grants Pass, and J. T. Logan, of Waldo.

PENNSYLVANIA

CORNWALL ORE BANK CO. (Cornwall)—Output is to be brought up to 80,000 tons monthly by November. Harrison Souder, general manager; J. W. McLaughlin, mine superintendent.

SOUTH DAKOTA

Custer County

CRAWFORD MICA (Pringle)—Regular shipments of scrap and plate mica being made to Eastern market. Will reopen old mica mine near Custer, adding compressor plant.

Lawrence County

ORO HONDO (Deadwood)—Good progress being made in sinking; shaft now 2150 ft. deep. Wages increased 10%.

Meade County

U. S. GYPSUM (Piedmont)—New 100-ton plaster mill placed in commission. Plant of steel construction. Mine opened sufficiently to assure good supply of gypsum.

TEXAS

FOARD COUNTY COPPER (Crowell)—This company developing copper deposit 12 miles northwest. Shipping to Omaha smeltery. H. P. Edwards, president.

UTAH

Salt Lake County

UTAH (Garfield)—April copper output was 17,231,512 lb.

UTAH APEX (Bingham)—After a shutdown of two months, owing to fire and subsequent flooding, this mine has resumed operation.

WISCONSIN

Zinc-Lead District

NEW EMPIRE (Platteville)—Has erected 50-ton mill.

NEW ROSE (Platteville)—First carload shipment from jigs assayed 55% Zn.

BENNETT (Platteville)—Levi Pollard has optioned this 40-acre tract north of city; formerly known as the Trego; will be drilled.

UTT-THORNE (Platteville)—Company has commenced mining at the Harris mine, at Mineral Point; idle many years.

CANADA

British Columbia

GRANBY CONSOLIDATED (Grand Forks)—This copper smeltery has been closed since second week of May on account of shortage of coke due to strike in Crows Nest Pass coal region.

CONSOLIDATED MINING AND SMELTING—Electrolytic zinc plant at Trail has established new record with output of 89,000 lb. in a single day, surpassing the contemplated maximum of 25 to 30 tons when production by the electrolytic process was undertaken.

Manitoba

NORTHERN MANITOBA MINING AND DEVELOPMENT (The Pas)—Recently shipped 586 sacks (56,995 lb.) of 4-oz. gold ore to Trail smeltery; taken out in sinking 51-ft. shaft on this Herb Lake property. Robert Kerr, of The Pas, is a director.

Ontario

ANCHORITE (Porcupine)—Plant will be installed by the Coniagas company of Cobalt, which has option.

WEST DOME (Porcupine)—Estimates developed ore of $500,000 gross value. Company has $132,000 in treasury.

McINTYRE (Schumacher)—Sinking main shaft of the Jupiter to 1000 ft., from which level it will develop the Plenaurum, under option.

KIRKLAND LAKE (Kirkland Lake)—Second payment of $75,000 made by the Beaver Consolidated. Total purchase price a little over $300,000.

BOSTON-HOLLINGER (Boston Creek)—Rich 5-ft. vein, containing much free gold, found about 150 ft. west of the original discovery.

PETERSON LAKE (Cobalt)—At annual meeting, W. A. Lamport was elected president and S. G. Forst, vice-president and managing director. In case ore is not opened in Susquehanna leasehold, 23 acres of conglomerate in the Cart Lake section will be prospected.

SCHUMACHER (Schumacher)—Report covering nine months ended Mar. 31 shows gross production of $169,186; net profits, $15,747, of which $3079 carried forward to surplus, making total surplus of $73,013. Average grade of ore milled was $5.24 per ton. Value of ore reserves estimated at $674,240.

HOLLINGER CONSOLIDATED (Timmins)—Report for four weeks ended Apr. 22 shows gross profits of $194,688 from treatment of 42,849 tons of average value of $9.20 per ton; working cost, $4.25 per ton milled. Mill ran only 72.6% of possible running time. Force employed has decreased from approximately 1300 in January to about 900 men, rendering it impossible to keep mill operating at capacity.

DOME (South Porcupine)—Operations curtailed by labor shortage. In place of 600 men required to bring output up to the normal, there are now only 375 men on payroll. About 1000 tons of ore are being treated daily, but grade is low, as with the reduced force it has been found impossible to bring up sufficient of the richer ore from the lower levels to maintain the average grade. Annual report to be issued, June 1, it is stated will show gross value of $18,000,000 for ore reserves.

MEXICO

ESPERANZA (El Oro)—Milled in March 23,865 tons; estimated profit, $64,400; February about $21,800.

HONDURAS

HONDURAS MINING AND DEVELOPMENT CO. (Galeras)—This company lately incorporated in New Mexico by El Paso, Texas, men. Property comprises 244 acres in department of Olancho, 30 miles from Juticalpa, on the Quebrada Garcia, a tributary of Rio Guayape. Bottom of 50-ft. shaft in ore running about 1 oz. gold. Several other veins also to be developed. R. H. Burrows, manager. Officers are: Arthur C. Brinker, president; Adolph Krakauer vice-president; E. J. Plumb, secretary; H. J. Baron, of El Paso, treasurer.

CHILE

CENTRAL CHILI (Panulcillo, Coquimbo)—Copper output for first quarter was 1,662,080 lb.

PERU

CERRO DE PASCO (La Fundicion)—Strike of employees at smeltery resulted in calling out of Peruvian troops on May 26. It is understood that mines are not involved.

RUSSIA

KYSHTIM (Kyshtim, Perm)—Copper output for four weeks ended Mar. 25 was 985,600 lb.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

May	Sterling Exchange	Silver New York, Cents	Silver London, Pence	May	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
24	4.7556	74⅛	37⅞	28	4.7556	74⅛	...
25	4.7556	74⅛	37⅞	29	4.7556	74⅛	37⅞
26	4.7556	74⅛	37⅞	30	.....	...	...

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

May	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	28⅛		10	10	9.25
24	@29	65	@11	@11	@9.35
	28⅛		10	10	9.25
25	@29⅛	64½	@11	@11	@9.35
	29⅛		10	10	9.25
26	@29⅛	64½	@11	@11	@9.35
	29⅛		10	10	9.25
28	@30	64½	@11	@11	@9.35
	29⅛		10	10	9.25
29	@30½	64½	@11	@11	@9.35
30	....	...	.....	.....	.....

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

May	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
24	130	129½	142	255¾	253¾	30½	54
25	130	129½	142	253¾	252	30½	54
26	....	....	...	....	....	....	...
28	....	....	...	....	....	....	...
29	130	129½	142	253½	251½	30½	54
30	....	....	...	....	....	....	...

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅟₂c.

NEW YORK—May 29, 1917

The markets for copper and lead ore were strong and active this week, there being a rather sharp advance in the price for copper. Lead was strong but unchanged in quotation for the major market, although carload lots for spot delivery realized higher and even fabulous prices. Tin was rather stagnant, without much change in price. Zinc was dull at unchanged prices.

Copper, Tin, Lead and Zinc

Copper—There was continued large buying, represented by many large transactions from day to day. We estimated the business of last week as upward of 30 million pounds. The aggregate this week was larger. Most of the business was for third-quarter delivery, and was shared by most of the principal selling agencies. Those who were especially desirous of selling fourth-quarter copper, and that only, reported scarcely any inquiry. There were few transactions for that late delivery in the early part of the week, but after that there were none, buyers at present being interested only in the third quarter. There is an occasional requirement for June copper, but that sort of business is trifling. For such little as is available 32½c., r.t., is asked; for July alone, 31@31½c., r.t. In the latter part of the week, third-quarter copper was sold in quantity at 30c., r.t., and at the close, agencies that had been selling at that price were asking more, while 30c., r.t., was realized for September alone. Brass makers and wire drawers were buyers during the week, and again there were a few sales for export.

Copper Sheets—The price of copper sheets has been reduced recently. We quote hot rolled at 38c. per lb., cold rolled 1c. higher. Wire is now quoted 34@36c., f.o.b. mill.

Tin—Scarcely anything was done.

Lead—A large tonnage was sold at 10½c. for May and June delivery, which is the best indication of the major market. The A. S. & R. Co. maintains its schedule price at 10c., and fills its existing contracts on that basis. A round lot of prompt metal changed hands at 10⅞c., St. Louis, but as above mentioned, the great tonnage was done at 10½c. For carload lots, spot or immediate delivery, higher, and what even may be characterized as fabulous prices, were realized. We heard of one carload being sold at 11.80c., delivered at Bridgeport. The lead market is in such a position that there is no difference in prices between New York and St. Louis, refiners at both places delivering on the same terms. At intermediate points all kinds of prices may be realized, according to time of delivery, or ability to make it at all.

Zinc—Only a moderate business in prime Western was reported, but there were some considerable sales of brass special and intermediate. Prompt and early spelter was pressed for sale all the time, while July and later was held at about ⅛c. premium. Sales of prompt were made at 9¼c. and plenty was to be had at that price right through the week. Brass special was sold at 9⅞@10c., St. Louis; intermediate, at 12c., New York; for high grade, 14c., New York, was quoted.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The aluminum market continues quiet and devoid of any features of special interest. Quotations continue at about the same level. 59@61c. per lb. for No. 1 ingots at New York.

Antimony—This market was again easier. We quote spot at 23@24c., but it is not unlikely that the price was shaded. We quote June-July shipment from China at 15@15½c., c.i.f., New York, duty unpaid.

Bismuth—Quoted at $2.75@3 per lb.

Cadmium—Quoted at $1.50 per lb.

Nickel—The market remains steady at 50@55c. per lb. for nickel. Electrolytic commands an additional 5c. per lb.

The government of Salvador, Central America, has authorized the coinage of nickel pieces having the value of 0.05 pesos each. The total amount to be coined is equal in 100,000 pesos.

Quicksilver—The price was unchanged at $100, New York. Market quiet.

Gold, Silver and Platinum

Gold—The movement in gold has not been such as to attract particular attention this week. No large shipments are chronicled, either outgoing or incoming.

Silver—Market has ruled firm and unchanged at 37⅞ pence in London the past week with small transactions. The differential in freight rates and insurance in favor of shipments to China and India via the Pacific continues to attract silver to San Francisco and large sales are being made in that quarter. As a result shipments to London are very limited. U. S. Mint continues to buy about 500,000 ounces weekly. The market closes firm with good undertone.

The Treasury Department announces the following purchases of silver: From the American Smelting & Refining Co. 200,000 oz. for delivery at Philadelphia at $0.7525 per oz., and 200,000 oz. for delivery at San Francisco at $0.7650 per oz.; from the United States Smelting Co., 100,000 oz. for delivery at San Francisco at $0.7650 per oz.

Mexican dollars at New York, May 23, 58⅛c.; 24, 58⅛c.; 25, 58⅛c.; 26, 58⅛c.; 28, 58c.

Platinum—Easier in tone owing to diminishing demand from jewelers. However, the price remained unchanged at $105.

Palladium—This metal is still in strong demand; the price remaining firm at $105.

Zinc and Lead Ore Markets

Platteville, Wis., May 26—Blende, basis 60% Zn, $78 for premium ore down to $72 for medium grade. Lead ore, basis 80% Pb, $129 per ton. Shipments reported for the week are 3316 tons of zinc ore, 277 tons of lead ore and 341 tons of sulphur ore. For the year to date the figures are: 54,749 tons of zinc ore, 2354 tons of lead ore and 10,819 tons of sulphur ore.

Joplin, Mo., May 26—Blende per ton, high $81.90; basis 60% Zn, premium ore $80, medium to low $77.50@70; calamine per ton, basis 40% Zn, $45@40; average selling price, all grades of zinc, $72.17 per ton.

Lead, high $121.35; basis 80% Pb $120@115; average selling price, all grades of lead $115.77 per ton.

Shipments the week: Blende, 9481 tons, calamine, 721 tons, lead, 1870 tons. Value, all ores the week, $952,760. Five months total blende, 180,612 tons, calamine, 17,161 tons, lead, 32,627 tons. Value, all ores five months, $19,154,590. Increase over last year's period: blende, 32,416 tons, calamine, 4695 tons; lead, 7468 tons, value, decrease, $270,190.

Heavier sales of medium to low grade ores dropped the average prices this week on both zinc and lead. Shipments are now greater than the production and the stock on hand is gradually lessening. Strong demand was a feature of the early to midweek, easing off at the close, with less tendency toward crowding the market next week.

Other Ores

Antimony Ore—Quoted nominally at $2.30 per unit.

Caesium Ore—Minimum content of caesium oxide 25%, quoted at $1 per lb., minimum package, 50 lb.[1]

Lithium Ore—Minimum content, 4% lithium oxide, in lumps, carloads in bulk, $35; less than carload; in barrels, per net ton, barrels included, $45. Ground to 100-mesh, $50 per net ton.[1]

Manganese Ore—Continues in strong demand. Ore of 49% quoted at $1 per unit.

Molybdenum Ore—All ores continue in demand Business in molybdenite was reported done at $2 per lb. of molybdenum sulphide in high-grade ores, 90% and upward.

Iron Ore—Prices nominally as noted last week. Delivered lower Lake ports; old range bessemer, $5.95; Mesaba bessemer, $5.70; old range non-bessemer, $5.20; Mesaba non-bessemer, $5.05.

Pyrites—Spanish ore, furnace size, quoted same as last week, 15½c. per unit on basis of 10s. freight, buyer paying war risk and excess freight. Domestic fines, mainly under contract at 10@10½c.

Tungsten Ore—Considerable business was reported, both domestic and foreign buyers being in the market, which is practically bare of supplies for early delivery. We quote $20 per unit.

Thorium Ore—Monazite sand, minimum, 5% thorium oxide, $55 per unit of ThO_2, or $350 per net ton of 6% sand.[1]

Yttrium Ore—Gadinolite, minimum 30% yttrium sesquioxide, 10% berillium oxide and 25% maximum lanthanum, didymium and cerium sesquioxides, 50c. per lb. in less than carloads.[1]

Iron Trade Review

NEW YORK, May 30

The most important feature in the market for pig iron during the week was a heavy purchase of steel-making iron by a Pittsburgh firm—30,000 tons. This order was placed with several eastern Pennsylvania furnaces at $42, for delivery during the last half of this year and the first half of next. In addition to the contracts already placed, the same concern is still in the market for from 15,000 to 20,000

[1]Quotations supplied by Foote Mineral Co., Philadelphia, Penn.

tons, but the furnaces hesitate to commit themselves even at an advanced price. A heavy tonnage of basic iron was also taken by steel manufacturers in the Middle West, estimated to have been in the neighborhood, all told, of 100,000 tons. It is understood that the prevailing price was $42 at the furnace. New York State manufacturers were also active buyers of foundry iron. Contracts were placed for upwards of 10,000 tons for delivery during the first half of next year. The result of these activities and of a considerable volume of small order business in the local market, but principally throughout New England, has been to advance prices all round about $1 a ton. No. 2 foundry, New York, as a basis, has gone up from $43.25 to $43.75 and $45.50. Since May 1 the total iron purchased for domestic use is estimated to have been 500,000 tons. Philadelphia has been a heavy buyer. A sale was reported early in the week of 15,000 tons of basic iron and of a large but unspecified tonnage of low phosphorus iron. The latter is said to have been sold at the furnace at from $41 to $42, or at the equivalent of $42.50 New York. New England business has been quite active for comparatively small lots of foundry iron for prompt and near-by shipment. It is estimated that there still remains a large tonnage to be placed in the West during the balance of the current year by foundrymen who have hesitated in the hopes of breaking through the market at some weak points, but who remain still with their needs unprovided for. Lake Superior charcoal iron is particularly scarce even at $50 to $51 a ton. The furnaces in all producing sections are so comfortably supplied with orders that they can afford to be very independent, and when it is a question of distributing the little near-by iron on hand, their favorite customers only get the benefit.

Steel activities during the week which ended last Saturday added to an already heavily overloaded market. Inquiries and orders came from all directions for export and domestic sources. Government requirements came first in order of importance under the understanding that orders having to do with American defense take precedence over all others. Navy yard requisitions for structural steel included a machine shop for which the lowest bid was $100 per ton, erected, and a foundry which will require $102 per ton to erect. Bids were also called for a power house at Norfolk, Va., and another at League Island, calling for 1000 tons each. A foundry will also be erected at the latter place, requiring 2100 tons, while a structural shop at the Brooklyn Navy Yard will consume 3500 tons. The War Department, too, is devising plans for thirty-two concentration camps. Each will be practically a city and house from 10,000 to 30,000 troops. The warehouses and storage buildings will be of steel. The tonnage required will be in the neighborhood of 140,000 to 150,000 tons. Hangars for the airplanes will consume an additional 100,000 tons. Motor trucks also figure largely in Government specifications for finished materials and will add to the general aggregate of steel tonnage. In all, 65,000 trucks and 10,000 automobiles are called for, the former weighing 1½ to 3 tons each.

It would seem that the iron-consuming industries have taken fright at the determined strength of their raw material, for, after a week or so of comparative quiet, the market has taken a buying spurt. Sales in the local market yesterday aggregated about 9000 tons and left at least 3500 tons called for and yet to be placed. One sale was for 1500 tons of foundry iron for delivery next year. Others were made up of three orders for 1000 tons each for New York and New Jersey consumption, also for delivery during 1918, and there were several scattered sales of 500 tons each, some of which were for the last half of the current year, the balance to be delivered during the first half of 1918. There were inquiries for an additional 1500 tons foundry iron for one consumer for shipment next year and 300 tons to another to be delivered before the close of 1917.

Ferroalloys

Ferromanganese—English material, 80%, $400@450. Domestic ferromanganese; spot, $425@450; July, $400@425; third quarter, $350@400; fourth quarter, $350@375.

Spiegeleisen—Spot, $80@85; contract, $75@85.

Ferrosilicon—Quotations on 50% material is $200@250. Bessemer ferrosilicon, 12%, $70@72.50.

Ferrotungsten—Quoted at $2.25@2.50 per lb.

Coke

Connellsville—Demand has quited down, but the supply is not overplentiful at Connellsville, and that market is very firm at quotations which in some instances have been advanced 50c. a ton over previous prices. There is little interest shown in contracts at this time, but the lack of buying interest has in no way interfered with the general strength of the market. The hestitancy is due largely to the uncertainty of car supply. Connellsville, furnace, $8.75@9; furnace contract, $8. Connellsville, foundry, $9.50@10; last half contract, $9.50@10.

STOCK QUOTATIONS

N. Y. EXCH.†	May 28
Alaska Gold M.	5½
Alaska Juneau	4½
Am.Sm.&Ref.,com.	104½
Am. Sm. & Ref., pf.	‡112½
Am. Sm. Sec., pf. A	‡97½
Am. Sm. Sec., pf. B	90
Am. Zinc	34⅛
Am. Zinc, pf.	66
Anaconda	84½
Batopilas Min.	1½
Bethlehem Steel	140
Bethlehem Steel, pf.	121
Butte & Superior	46½
Cerro de Pasco	37
Chile Cop.	23½
Chino	57⅛
Colo.Fuel & Iron	53
Crucible Steel	79½
Dome Mines	11½
Federal M. & S.	16
Federal M. & S., pf.	44½
Great Nor., ore ctf.	35
Greene Cananea	44⅛
Gulf States Steel	128
Homestake	107½
Inspiration Con.	63
International Nickel	42⅛
Kennecott	48⅜
Lackawanna Steel	96⅛
Miami Copper	40½
Nat'l Lead, com.	57½
National Lead, pf.	105
Nev. Consol	25½
Ontario Min.	5½
Quicksilver	2⅛
Quicksilver, pf.	1½
Ray Con	30⅛
Republic I.&S.,com.	90½
Republic I. & S. pf.	‡103½
Sloss-Sheffield	61½
Tennessee C. & C.	16⅛
U. S. Steel, com.	132⅛
U. S. Steel, pf.	119½
Utah Copper	114⅛
Va. Iron C. & C.	69½

N. Y. CURB†	May 28
Big Ledge	3⅛
Butte & N. Y.	1½
Butte C. & Z.	11⅛
Caledonia	.55
Calumet & Jerome	1½
Can. Cop. Corpn.	2 1/16
Carlisle	5
Con. Ariz. Sm.	2½
Con. Coppermines	5½
Con. Nev.-Utah	1/16
Emma Con.	1½
First Nat. Cop.	3
Goldfield Con.	.52
Goldfield Merger	.05½
Greenmonster	1 1/16
Hecla Min.	8⅛
Howe Sound	6
Jerome Verde	1 1/16
Joplin Ore & Spel.	.15
Kerr Lake	4⅛
Magma	45½
Majestic	.47
McKinley-Dar-Sa.	.51
Mohican	.75
Mother Lode	.31
N. Y. & Hond.	14
Nipissing Mines	7½
Ohio Cop.	1⅛
Ray Hercules	4
Rochester Mines	.61
St. Joseph Lead	19
Seneca	9
Standard S. L.	1 1/16
Stewart	1/16
Success	.34
Tonopah	6
Tonopah Ex.	2½
Tribullion	1/16
Troy Arizona	.35
United Cop.	1/16
United Verde Ext.	36½
United Zinc	5½
White Knob, pf.	1⅛
White Oaks	⅛
Yukon Gold	1⅛

SAN FRAN.*	May 28
Alta	.04
Andes	.10
Best & Belcher	.05
Bullion	.02
Caledonia	.14
Challenge Con.	.01
Confidence	.10
Con. Virginia	.50
Gould & Curry	.02
Hale & Norcross	.05
Jacket-Cr. Pt.	.05
Mexican	.21
Occidental	.05
Ophir	.06
Overman	.04
Savage	.05
Seg Belcher	.02
Sierra Nevada	.08
Union Con.	.22
Utah Con.	.01
Belmont	3.95
Jim Butler	.80
MacNamara	.19
Midway	.12
Mont.-Tonopah	.19
North Star	.10
Rescue Eula	.23
West End Con.	.72
Atlanta	.10
Booth	.07
Comb. Frac.	.04
D'field Daisy	.03
Florence	.19
Jumbo Extension	.41
Kewanas	.15
Nevada Hills	.25
Nevada Packard	.36
Round Mountain	.37
Silver Pick	.10
White Caps	1.37½
Big Jim	.72
Nellie	‡.15½
Tom Reed	‡1.93½
United Eastern	4.25

BOSTON EXCH.*	May 28
Adventure	3½
Ahmeek	101
Algomah	.60
Allouez	64½
Ariz. Com., ctfs.	13½
Arnold	.30
Bonanza	.20
Butte-Ballaklava	.65
Calumet & Ariz.	82½
Calumet & Hecla	555
Centennial	19½
Copper Range	63½
Daly West	1½
Davis-Daly	6
East Butte	13½
Franklin	6½
Granby	84
Hancock	15½
Hedley	16
Helvetia	.40
Indiana	2½
Island Cr'k, com.	71
Isle Royale	‡30½
Keweenaw	2½
Lake	13
La Salle	3½
Mason Valley	5½
Mass	1⅜
Mayflower	2½
Michigan	3½
Mohawk	90½
New Arcadian	3½
New Idria	15
North Butte	22½
North Lake	1½
Ojibway	1
Old Colony	‡2½
Old Dominion	62½
Osceola	90
Quincy	91½
St. Mary's M. L.	82
Santa Fe	1½
Shannon	8½
Shattuck-Ariz.	28
So. Lake	3½
So. Utah	.20
Superior	9½
Superior & Bost.	5 3/16
Trinity	4½
Tuolumne	1½
U. S. Smelting	61
U. S. Smelt'g, pf.	50½
Utah Apex	3
Utah Con.	17½
Utah Metal	5½
Victoria	4½
Winona	3½
Wolverine	43
Wyandot	‡.90

BOSTON CURB*	May 28
Alaska Mines Corp.	⅜
Bingham Mines	12½
Boston Ely	.55
Boston & Mont.	.56
Butte & Lon'n Dev.	.22
Calaveras	4½
Calumet-Corbin	.01½
Chief Con.	2½
Cortez	.12
Crown Reserve	.30
Crystal Cop	.94
Eagle & Blue Bell	1½
Houghton Copper	.90
Intermountain	1 1/16
Iron Cap Cop., pf.	17½
Mexican Metals	.26
Mines of America	1½
Mojave Tungsten	.42
Nat. Zinc & Lead	.67
Nevada-Douglas	1½
New Baltic	1½
New Cornelia	16½
Oneco	.50
Pacific Mines	‡.25
Rex Cons	.32

SALT LAKE*	May 28
Bannack	1.15
Big Four	.46
Black Jack	.06
Cardiff	6.55
Colorado Mining	.17
Crown Point	‡.05
Daly-Judge	8.35
Empire Copper	1.25
Gold Chain	.11
Grand Central	.45
Iron Blossom	1.10
Lower Mammoth	.03
May Day	.06½
Moscow	.12
Prince Con.	1.25
Silver-King Coal'n	3.00
Silver King Con.	3.75
Sioux Con.	.10½
So. Hecla	1.10
Uncle Sam	.02½
Wilbert	.10
Yankee	.10

TORONTO*	May 28
Bailey	.03
Beaver Con.	.32
Buffalo Mines	.95
Chambers Feriand	‡.10
Coniagas	3.50
La Rose	.43
Peterson Lake	.09½
Right of Way	.04
T. & Hudson Bay	38.00
Temiskaming	.38
Wettlaufer-Lor.	.05
Dome Exten.	.14
Dome Lake	.17
Foley O'Brien	.70
Hollinger	4.30
Jupiter	.28
McIntyre	1.47
Newray	.72
Porcu. Crown	.54
Schumacher	.41
Vipond	.38
West Dome	.19½

STOCK QUOTATIONS—Continued

COLO. SPRINGS	May 28
Cresson Con.	5.37½
Doctor Jack Pot.	.04½
Elkton Con.	.06½
El Paso	.30
Gold Sovereign	.03½
Golden Cycle	2.22
Granite	.50
Isabella	.11
Mary McKinney	.20
Portland	1.50
United Gold M.	.16½
Vindicator	.72

LONDON	May 10		
Alaska Mexican	£0	10s	0d
Alaska Tre'dwell	1	15	0
Burma Corp.	4	2	6
Cam & Motor	0	8	9
Camp Bird	0	7	0
El Oro	0	9	0
Esperanza	0	10	6
Mexico Mines	4	0	0
Nechi, pfd.	0	14	0
Oroville	0	15	3
Santa Ger t'dis	0	10	6
Tomboy	0	19	3

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269		23.570	35.477	
June	49.034	65.024		23.267	31.060	
July	47.519	62.940		22.597	30.000	
August	47.163	66.083		22.780	31.498	
September	48.680	68.515		23.591	32.584	
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625		135.457		152.522	
June	26.601		112.432		137.455	
July	23.865		95.119		125.500	
Aug.	26.120		110.283		126.304	
Sept.	26.855		113.905		134.071	
Oct.	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
March	51.230	55.910	199.736	220.171
May	49.125		196.511	
June	42.231		179.466	
July	38.510		168.357	
August	38.565		169.870	
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.000
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463		7.332		32.967	
June	6.936		6.749		31.011	
July	6.352		6.185		28.137	
August	6.244		6.088		29.734	
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276		14.106		94.217	
June	11.752		11.582		68.591	
July	8.925		8.755		50.750	
Aug.	8.730		8.560		51.587	
Sept.	8.990		8.820		52.095	
Oct.	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ‡ Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78		19.11		19.58	
June	21.95		18.95		19.34	
July	21.95		18.95		19.20	
August	21.95		18.95		19.22	
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.

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